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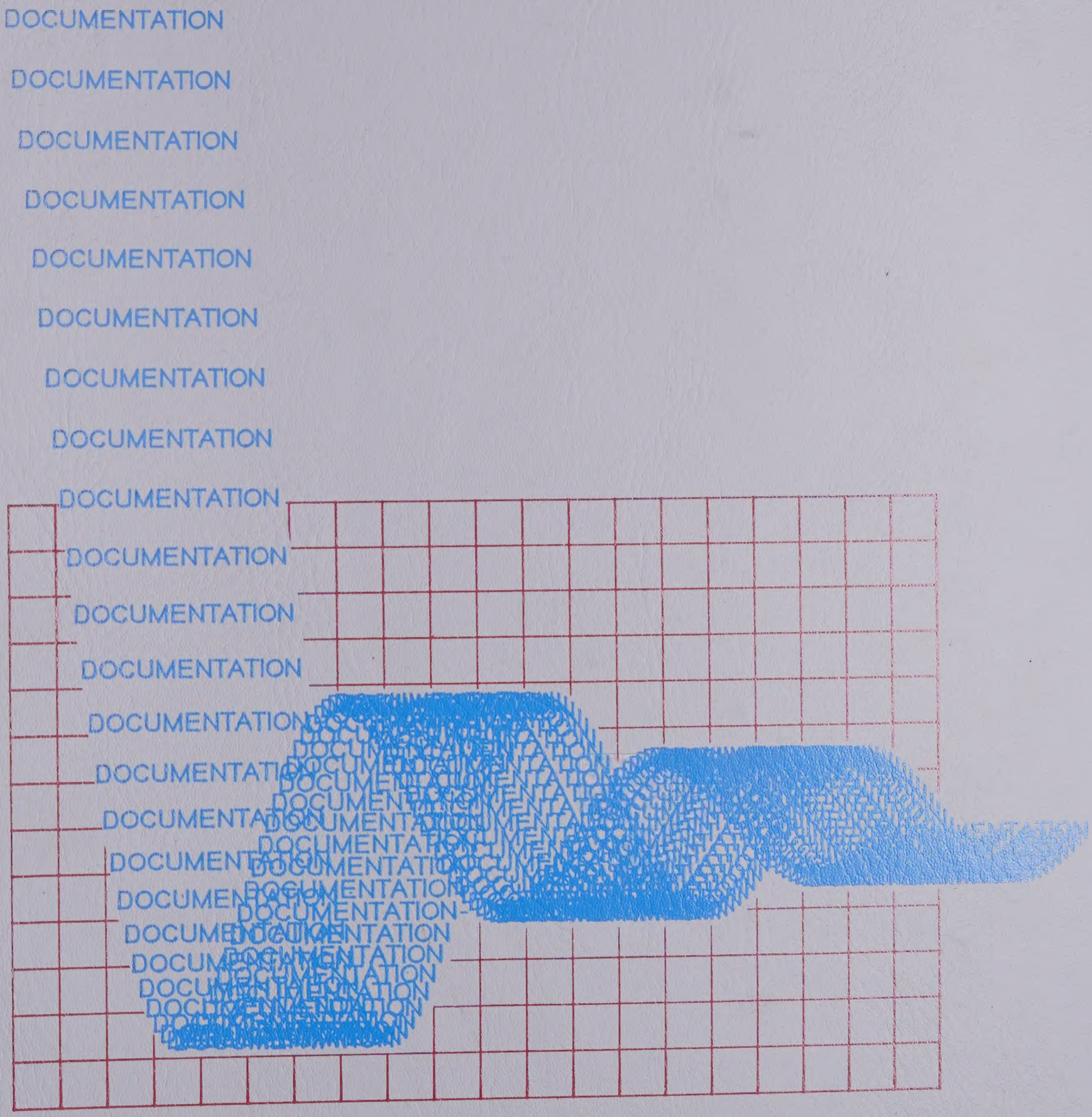
DOCUMENTATION

ROHDE&SCHWARZ
Test and Measurement
Division

Operating Manual

Software Options:

GSM400/900/1800/1900-BTS for CMU-B21

CMU-K30/-K31/-K32/-K33

1115.4004.02/1115.4104.02/1115.4204.02/1115.4304.02

Including MOC/MTC (CMU-K39)

1115.4791.02

8PSK software extension for CMU-K3x (CMU-K41)

1115.4604.02

Printed in the Federal
Republic of Germany

Tabbed Divider Overview

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Certificate of Quality
List of R&S Representatives

Contents of Manuals for Universal Radio Communication Tester CMU

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3 Chapter 3: Manual Operation

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Contents of Manuals for Universal Radio Communication Tester CMU

Operating Manual CMU-K30/-K31/-K32/-K33, CMU-K41, CMU-K39

(Software Options: GSM400/900/1800/1900-BTS for CMU-B21, including EDGE and MOC/MTC)

The present operating manual describes the application of CMU for GSM base station tests. It gives comprehensive information about the installation of the required software options and about manual and remote control of the instrument. For introduction, some typical measurement tasks are explained in detail using the functions of the graphical user interface.

The manual is organized as follows:

Chapter 1	Describes the steps necessary for installing the software and putting the instrument into operation.
Chapter 2	Gives an introduction to the application of the CMU for GSM base station tests and presents typical measurement examples.
Chapter 3	Gives an overview of the user interface and describes the concepts of measurement control and instrument configuration.
Chapter 4	Represents the reference chapter providing detailed intormation on all functions of the user interface and their application.
Chapter 5	Describes the basics of remote control of the instrument for GSM base station tests.
Chapter 6	Lists all remote control commands for GSM base station tests. At the end of the chapter the commands are grouped together according to their function (measurement groups or configurations) and sorted in alphabetical order.
Chapter 10	Contains an index for the operating manual.

Operating Manual CMU

In the operating manual for CMU basic unit you will find information about the technical specifications of the CMU, the controls and connectors on the front and rear panel, necessary steps for putting the instrument into operation, the basic operating concept, manual and remote control. Typical measurement tasks are explained in detail using the functions of the user interface and program examples. In addition, the operating manual lists the most important warnings and error messages which may be output by the instrument.

General concepts of CMU control are described in the operating manual CMU and not repeated in the manuals for the individual software options.

Service Manual Instrument

The service manual instrument informs on how to check compliance with rated specifications, on instrument function, repair, troubleshooting and fault elimination. It contains all information required for the maintenance of CMU by exchanging modules.

Service Manual Modules

The service manual modules is not delivered with the instrument but may be obtained from your R&S service department using the order number 1100.4903.91.

Service manual modules contains information about the individual modules of CMU. This comprises the test and adjustment of the modules, fault detection within the modules and the interface description.

Further Operating Manuals for Network Tests

The operating manuals listed in the following table describe the test of radio communication equipment supporting different standards by means of the CMU and the appropriate software and hardware options. The network test operating manuals are organized like the present GSM-BTS operating manual.

		For Options		
Manual	**Order Number**	**Type**	**Description**	**Stock No.**
Operating Manual CMU-K21/-K22/-K23	1115.6088.12	CMU-K21 CMU-K22 CMU-K23	GSM900-MS for CMU-B21 GSM1800-MS for CMU-B21 GSM1900-MS for CMU-B21	1115.6007.02 1115.6107.02 1115.6207.02
Operating Manual CMU-K27/-K28	1115.6688.12	CMU-K27 CMU-K28	TDMA800-MS for CMU-B21 TDMA1900-MS for CMU-B21	1115.6607.02 1115.6707.02
Operating Manual CMU-K29	1115.6888.12	CMU-K29	AMPS-MS for CMU-B21	1115.6807.02
Operating Manual CMU-K53	1115.5081.12	CMU-K53	Bluetooth for CMU	1115.5000.02
Operating Manual CMU-K81/-K82	1115.5581.12	CMU-K81 CMU-K82	CDMA800-MS (IS95) for CMU-B81 CDMA1900-MS (IS95) for CMU-B81	1115.5500.02 1115.5600.02

Frequently Used Abbreviations

Abs.	*Absolute*
AF	*Audio Frequency*
AGC	*Automatic Gain Control*
Att.	*Attenuation*
BCC	*BTS Color Code*
BCCH	*Broadcast Control Channel*
BER	*Bit Error Rate*
BS	*Base (Transceiver) Station*
BSIC	*Base Transceiver Station Identity Code*
BTS	*Base Transceiver Station*
CC	*Call Control*
CCH	*Control Channel*
Ch./Chan.	*Channel*
Chan.	*Channel*
Config.	*Configuration*
CRC	*Cyclic Redundancy Check*
CS	*Coding Scheme*
Disp.	*Display*
DUT	*Device Under Test*
EFS	*Enhanced Full Rate Speech*
Err.	*Error*
Err. Vect. Magn.	*Error Vector Magnitude*
EVM	*Error Vector Magnitude*
Ext.	*Extended*
Ext. Att.	*External Attenuation*
FAC	*Final Assembly Code*
FER	*Frame Erasure Rate*
FS	*Full Rate Speech*
GMSK	*Gaussian Minimum Shift Keying*
GSM	*Global System for Mobile Communication, Groupe Spécial Mobile*
HS	*Half Rate Speech*
IF	*Intermediate Frequency*
IMEI	*International Mobile Station Equipment Identity*
Loc. Area	*Location Area (Code)*
Loc. Update	*Location Update*
Magn.	*Magnitude*
Max.	*Maximum (Level etc.)*
MCC	*Mobile Country Code*
ME	*Magnitude Error*
Meas.	*Measurement*
MM	*Mobility Management*
MNC	*Mobile Network Code*
MOC	*Mobile Originated Call*
MS	*Mobile Station*
MTC	*Mobile Terminated Call*
NB	*Normal Burst*
NCC	*PLMN Color Code*
Norm.	*Normal (burst)*
Ovw.	*Overview*
P/t	*Power versus time*
PE	*Phase Error*
Ph.	*Phase*
PIN	*Personal Identification Number*
PLMN	*Public Land Mobile Network*
Pop.	*Popup (menu)*
PRBS	*Pseudo Random Bit Sequence*
PSK	*Phase Shift Keying*
PSR	*Pseudo Random (Sequence)*
RACH	*Random Access Channel*
Ref.	*Reference*
Rel.	*Relative*
RF	*Radio Frequency*
RMS	*Root Mean Square (averaging)*

RR	*Radio Resources*
RX	*Receiver*
SACCH	*Slow Associated Control Channel*
SCH	*Synchronization Channel*
SIM	*Subscriber Identity Module*
SNR	*Serial Number*
Srch.	*(BER) Search (mode)*
SVN	*Software Version Number*
Sync./Synch.	*Synchronization*
TAC	*Type Approval Code*
TCH	*Traffic Channel*
TDMA	*Time Division Multiple Access*
Trg.	*Trigger*
TS	*Timeslot*
TSC	*Training Sequence (Code)*
TX	*Transmitter*
Vect.	*Vector*

Supplement to the Operating Manual for Software Options CMU-K30/-K31/-K32/-K33

GSM400/900/1800/1900-BS for CMU-B21

Dear CMU Customer,

In combination with options CMU-K30/-K31/-K32/-K33, your Universal Radio Communication Tester CMU300 offers an extended measurement functionality which could not yet be reported in the current revision of the operating manual, stock no. 1115.4185.12-01-:

- A new application has been added to the *Receiver Quality* measurements where the BTS does not close its RF loop to send back the data received but generates a PCM signal that is received at the CMU via Abis interface. A separate menu is provided to configure the Abis interface. Abis BER tests require option CMU-B71, *Abis Interface Unit for CMU*, to be fitted.
- The list of *TCH Channel Type* options has been extended by the GPRS and EGPRS coding schemes.
- With firmware V2.92, GSM850 tests (option CMU-K34) are available.

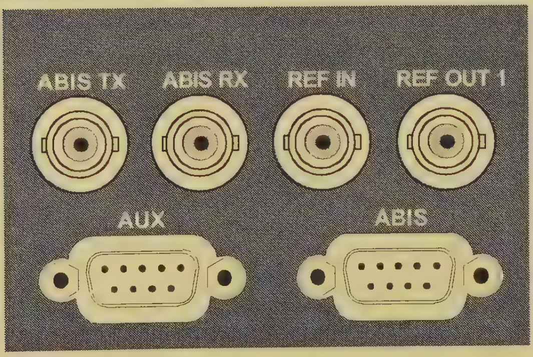
The following pages are to provide you with all necessary information concerning the purpose and use of the Abis BER tests.

Abis BER Tests (with Option CMU-B71)

The menu group *Receiver Quality* measures parameters which characterize the quality of transmission on the complete transmission path from the CMU to the device under test (base station) and back. In particular, assuming that transmitter errors do not occur, this allows to assess the sensitivity of the base station receiver at low RF power levels.

Receiver Quality measurements are based on the comparison of the output signal generated by the CMU with the signal received and decoded by the device under test (base station). To make this possible, the BTS must return the received signal to the CMU. Two essentially different principles are used:

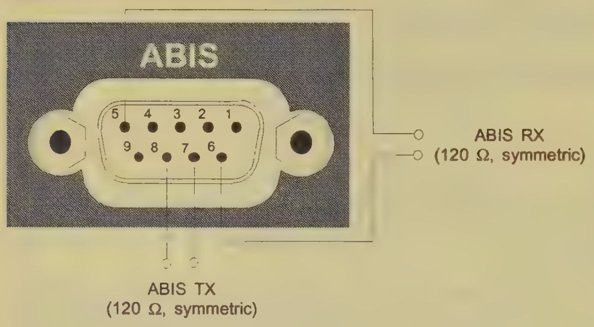
- In the RF (CMU) mode, the BTS is set to close its RF loop, which can be done either directly after demodulating the received RF signal or after the channel decoder. The received data is looped back on the RF channel; a cyclic redundancy check (CRC) excludes bit errors on the return path from the BTS to the CMU. The benefit of this measurement principle is that, besides the ordinary RF coax cable, no extra cabling is needed and that the bit error rate can be measured on 8PSK, GPRS and EGPRS channels as well.
- In the Abis mode, the BTS decodes the data received and generates a Pulse Code Modulation (PCM) signal that is directly applied to the CMU's Abis interface. This by-passes all voice processing stages in the return path from the BTS under test to the CMU so that bit errors in the return path are largely excluded.



Two alternative connectors can be used as an input to the CMU's Abis interface:

- The 75 Ω BNC connector ABIS RX on the rear panel.
- The 120 Ω symmetric 9-contact SUB-D connector ABIS on the rear panel.

Which connector is used depends on the Abis output connector of the base station under test. The CMU output connector ABIS TX is intended for future extensions.


ABIS
5 4 3 2 1
9 8 7 6
ABIS RX
(120 Ω, symmetric)
ABIS TX
(120 Ω, symmetric)

The pin assignment of the symmetric (balanced) Abis connector is shown on the left side.

Fig. 1 below illustrates the signal paths for the RF (CMU) and the Abis measurement. In the *Receiver Quality* menu, the *CMU Abis* hotkey switches over between the RF *(CMU)* and the *Abis* mode.

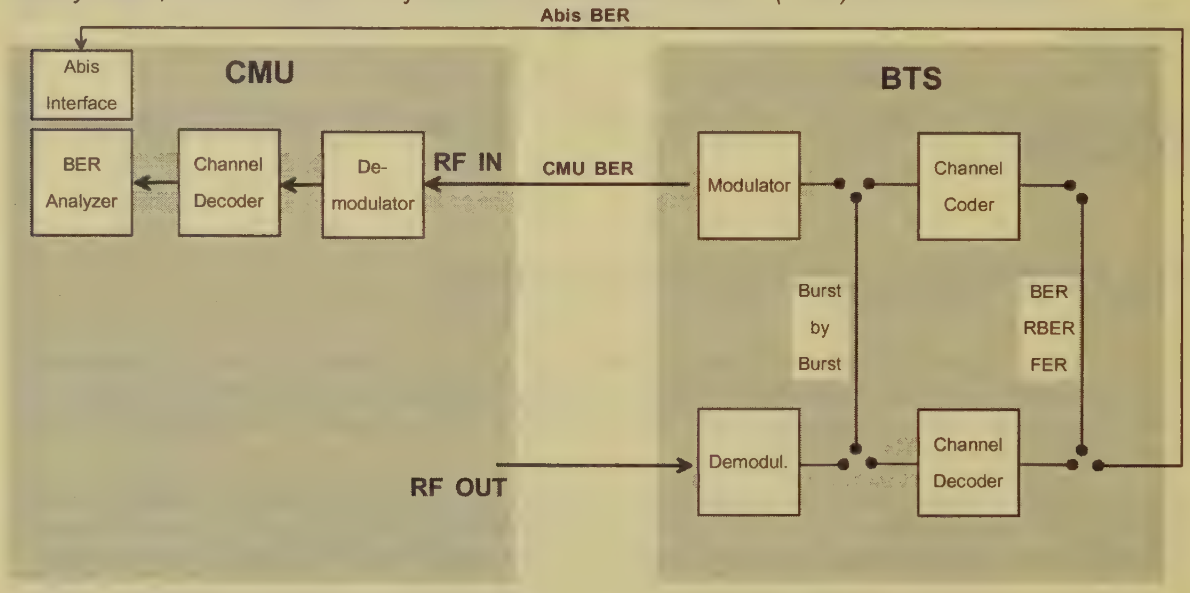

Abis BER
Abis Interface
CMU
BER Analyzer
Channel Decoder
De-modulator
RF IN
CMU BER
RF OUT
BTS
Modulator
Channel Coder
Burst by Burst
BER RBER FER
Demodul.
Channel Decoder

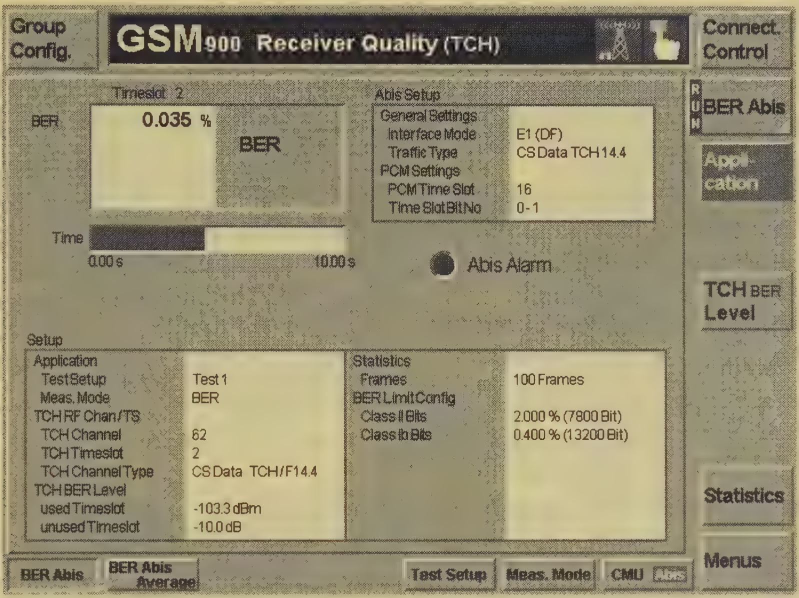
Fig. 1 Signal paths for BER measurements

Main Menu (Receiver Quality)

The main menu *Receiver Quality* shows the results and the most important parameters of the *Receiver Quality* measurement.

The measurement menu *Receiver Quality* is opened from the main menu *Menu Select* (with the associated key at the front of the instrument) or from the menu group *GSM400/900/1800/1900-BTS Signalling* using the hotkey *Receiver Quality*.

Menu Select



Timeslot 2
BER 0.035 %
BER
Time 0.00 s 10.00 s

Abis Setup
General Settings
Interface Mode: E1 (DF)
Traffic Type: CS Data TCH 14.4
PCM Settings
PCM Time Slot: 16
Time Slot Bit No: 0 - 1

Setup
Application
Test Setup: Test 1
Meas. Mode: BER
TCH RF Chan / TS
TCH Channel: 62
TCH Timeslot: 2
TCH Channel Type: CS Data TCH/F14.4
TCH BER Level
used Timeslot: -103.3 dBm
unused Timeslot: -10.0 dB

Statistics
Frames: 100 Frames
BER Limit Config
Class II Bits: 2.000 % (7800 Bit)
Class Ib Bits: 0.400 % (13200 Bit)

Fig. 2 Main menu Receiver Quality

Test Settings

The test settings for the Receiver Quality measurement are described in chapter 4 of the CMU-K30/-K31/-K32/-K33 operating manual. With the introduction of the Abis mode, a new hotkey is added to the hotkey bar associated to the *Application* softkey.

Appli-cation

The *Application* softkey selects the application, test setup, measurement mode and measurement principle.

Three different applications are provided for each of the two measurement principles *CMU* and *Abis*. The results for the alternative applications are displayed in different measurement menus. When an application is selected, the corresponding measurement menu is called up. The configuration settings for all applications, however, are listed in a common popup-menu.

CMU Abis

The *CMU Abis* hotkey toggles between the RF (CMU) and Abis measurement principle. The principle currently selected is marked in inverse video (white typeface on a dark background). Selecting a measurement principle also changes the measurement menu, the *BER <Principle>*, *BER <Principle> Average* and *BER <Principle> Search* hotkeys and the main softkey in the *Receiver Quality* menu.

Remote control

No explicit switchover command. ABIS measurements are identified by the 2nd/3rd level keywords `...RXQuality:ABIS...`

Measurement Results

The values shown in the measurement menu *Receiver Quality* can be divided into different groups:

- Measurement results and the progress of the measurement are reported in the upper left quarter of the menu.
- The configurations of the current measurement are shown in the table below *(Setup)*.
- If one of the Abis applications is selected, the configurations of the Abis interface *(Abis Setup)* and the status of the alarm monitor are displayed in the upper right quarter of the menu. The *Abis Alarm* LED symbol turns red if one of the four alarm events shown in the *Abis* tab of the *Connection Control* menu (see section *Abis Interface Configuration (Connection Control – Abis)* on page 4) is detected. The *Abis Setup* is also defined in the *Abis* tab.

The results of the Abis applications depend on the *Meas. Mode* selected:

- In the *RBER/FER* measurement mode, the residual bit error rate for class Ib and class II bits and the frame erasure rate is determined.
- In the *BER* measurement mode, the bit error rate for class Ib and class II bits is determined.

The bit classes can be unambiguously derived from the position of the individual bits within the PCM frames. The Abis results are thus identical to the RF (CMU) results, except that no CRC errors are measured and no raw bit error rate *(Burst by Burst* mode) is available.

Measurement Configurations (*Receiver Quality Configuration*)

The popup menu *Receiver Quality Configuration* contains three tabs which determine the parameters for measurement of the bit error rate.

The popup menu *Receiver Quality Configuration* is activated by pressing the softkey *BER ABIS* at the top right in the main menu *Receiver Quality* twice (this softkey reads *BER ABIS*, *BER ABIS Average,* depending on the selected application). It is possible to change between the tabs by pressing the associated hotkeys.

The Abis configuration parameters are analogous to the RF (CMU) configurations.

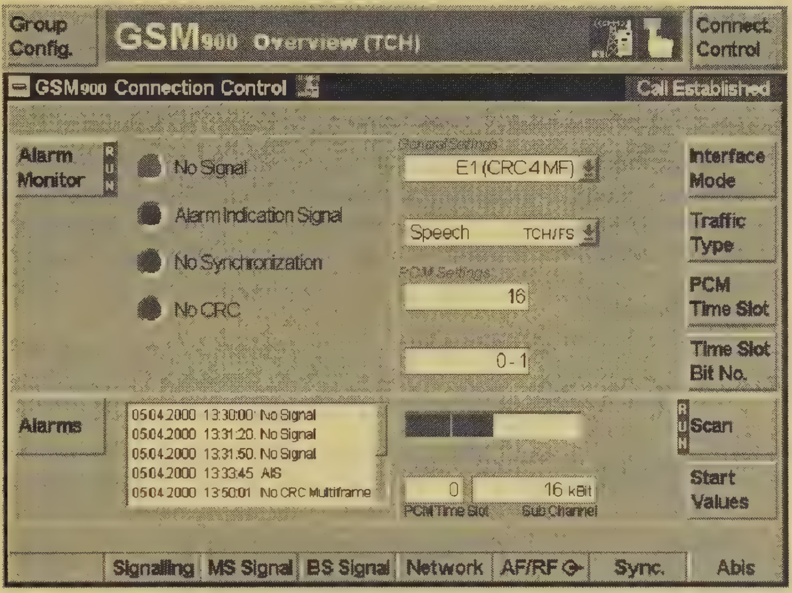
Abis Interface Configuration (Connection Control – Abis)

The *Abis* tab monitors the input signal at the Abis interface and provides interface settings. This includes:

- Control of the *Alarm Monitor* and recording of the alarm events *(Alarms)*
- Selection of the Abis link protocol *(Interface Mode)*
- Coding scheme and transmission rate of the BTS traffic channel *(Traffic Type)*
- Timeslot number and bit no. of the PCM signal *(PCM Time Slot, Time Slot Bit No.)*
- Automatic search for the traffic channel on the Abis interface *(Scan)* with appropriate setting of *Start Values*

Like the other tabs in the *Connection Control* menu, the Abis tab can be called up by pressing the *Connect. Control* softkey at the top right in every measurement menu followed by the *Abis* hotkey. By pressing the *Escape* key, the *Connection Control* menu is closed and the CMU changes to one of the measurement menus.

Connect Control →


Group Config.
GSM900 Overview (TCH)
Connect. Control
GSM900 Connection Control
Call Established
Alarm Monitor
RUN
No Signal
Alarm Indication Signal
No Synchronization
No CRC
General Settings
PCM Settings
Interface Mode
Traffic Type
PCM Time Slot
Time Slot Bit No.
Alarms
RUN
Scan
Start Values
Signalling
MS Signal
BS Signal
Network
AF/RF
Sync.
Abis

Interface Mode: E1 (CRC4 MF)

Traffic Type: Speech TCH/FS

PCM Time Slot: 16

Time Slot Bit No.: 0 - 1

PCM Time Slot: 0

Sub Channel: 16 kBit

```
05.04.2000  13:30:00  No Signal
05.04.2000  13:31:20. No Signal
05.04.2000  13:31:50. No Signal
05.04.2000  13:33:45  AIS
05.04.2000  13:50:01  No CRC Multiframe
```

Fig. 3 Connection Control – Abis

Alarm Monitor

The *Alarm Monitor* softkey controls the alarm monitor and indicates its status *(RUN or OFF)*. The status can be toggled after softkey selection (pressing once) by means of the *ON/OFF* key.

Note: *The* Alarm Monitor *and the* Scan *can not be active at the same time. To switch on the* Alarm Monitor, *the* Scan *must be switched off and vice versa.*

The alarm monitor is to monitor the signals at Abis input ABIS or ABIS RX; see interface description in section *Abis BER Tests* on page 1. If an abnormal event is detected, one of the green LED symbols to the right of the softkey turns red and an error message is written to the log table displayed below (see *Alarms* softkey).

Four different types of events can be detected:

No Signal	One of the following scenarios is detected: – No input signal at Abis input. – Input signal too low. – Input signal has no PCM frame structure. – The PCM signal is an all zeroes signal, i.e. it contains not more than three ones within a period of 250 µs.
Alarm Ind. S.	The PCM signal is an all ones signal (Alarm Indication Signal, AIS), i.e. it contains not more than two zeroes within a period of 250 µs.
No Synch.	Four consecutive false Frame Alignment Signals (FAS) or four consecutive false Not Frame Alignment Signals (NFAS) were identified in the PCM signal.
No CRC	The Cyclic Redundancy Check (CRC) was not able to identify a CRC4 multiframe or the error rate of the CRC exceeded the threshold of 91%. CRC errors are detected only if one of the modes *E1(CRC4MF)* or *T1(CRC6ESF)* is selected; see *Interface Modes* softkey below.

The four alarm types can be monitored simultaneously; however, if *No Signal* is detected, the CMU is not able to check the remaining alarm types. The status of the alarm monitor is updated roughly every second.

Remote control
`INITiate:ABIS:ALARmmonitor; ABORt:ABIS:ALARmmonitor`
`SENSe:ABIS:ALARmmonitor?` etc.

Alarms

The *Alarms* softkey selects the alarm monitor log table for scrolling. The table shows all alarm events detected in the current measurement session together with the time of recording. The four alarm event types *No Signal, AIS (Alarm Indication Signal), No Synchronization* and *No CRC Multifr*ame are described above.

Remote control
`SENSe:ABIS:ALARmmonitor?`

Interface Mode

The *Interface Mode* softkey selects one of the supported Abis link protocols.

E1(DF)	Double frame
E1(CRC4MF)	CRC4 multiframe
T1(SF)	Standard frame
T1(ESF)	Extended standard frame
T1(CRC6ESF)	CRC6 extended standard frame

The *E1(CRC4MF)* or *T1(CRC6ESF)* link protocol must be selected to detect *No CRC Multiframe* alarm events.

Remote control
```
CONFigure:ABIS:IMODe
      E1DF | E1CRc4mf | T1SF | T1ESf | T1CRc6esf
```

Traffic Type

The *Traffic Type* softkey selects the coding scheme and the transmission rate in the BTS traffic channel transferred via Abis interface. The following options are provided:

Speech TCH/FS	Standard full rate speech coding
Speech TCH/EFS	Enhanced full rate speech coding
Speech TCH/HS	Half rate speech coding
CS Data TCH/F14.4	Full rate data with a transmission rate of 14 400 baud
CS Data TCH/F9.6	Full rate data with a transmission rate of 9 600 baud
CS Data TCH/F4.8	Half rate or full rate data with a transmission rate of 4 800 baud

Compared to the complete list of traffic channel types provided in the *Signalling (Unsynchronized)* tab of the *Connection Control* menu, 8PSK, GPRS and EGPRS channels are not supported. If one of these channel types are selected in the *Signalling* tab and the Abis interface is used, the CMU displays a warning message.

Remote control
`CONFigure:ABIS:TTYPe TTFR | TTEFr | TTHR | TF14 | TF96 | TF48`

PCM Time Slot

The *PCM Time Slot* softkey selects the timeslot for the PCM (Pulse Code Modulation) traffic channel signal.

In the E1 (T1) interface modes, the PCM signal is divided into 32 (25) timeslots. Timeslot no. 0 is reserved for frame synchronization; each of the remaining timeslots contains 8 data bits corresponding to a 64 kbit/s channel. Consequently, one of the timeslots 1 to 31 (1 to 24) can be selected for the E1 (T1) interface mode.

Remote control
`CONFigure:ABIS:PCMTimeslot <numeric>`

Time Slot Bit No.

The *Time Slot Bit No.* softkey selects the bit numbers within the PCM timeslot that define a full rate or half rate channel.

The 64 kbit/s channel of a full timeslot can be divided into 4 full rate sub channels with a transmission rate of 16 kbit/s each, occupying a pair of consecutive bits (0-1, 2-3, 4-5, 6-7). A half rate sub channel with a transmission rate of 8 kbit/s occupies only one of the bits 0 to 7.

Remote control
`CONFigure:ABIS:TSBitno BN01 | BN23 | BN45 | BN67 | BNR0 | BNR1 | BNR2 | BNR3 | BNR4 | BNR5 | BNR6 | BNR7`

Scan

The *Scan* softkey controls the automatic search for the traffic channel on the Abis interface and indicates its status *(RUN / OFF)*. The status can be toggled after softkey selection (pressing once) by means of the *ON/OFF* key.

The scan routine searches from the *PCM Time Slot* defined with the *Start Values* softkey below upwards. The results of the *Scan* supersede the *PCM Time Slot* and *Time Slot Bit No.* settings.

Note: *The* Alarm Monitor *and the* Scan *can not be active at the same time. To switch on the* Alarm Monitor, *the* Scan *must be switched off and vice versa.*

Remote control
`INITiate:ABIS:SCAN; ABORt:ABIS:SCAN`
`SENSe:ABIS:SCAN?` etc.

Start Values

The *Start Values* softkey sets a start value for the *PCM Time Slot* and defines whether the *Scan* searches for a full rate or half rate sub channel. The *Start Values* are of particular importance if several channels of the PCM signal are occupied.

The scan routine searches from the *PCM Time Slot* defined with the *Start Values* softkey upwards. The data rate of the sub channel (full rate channels with 16 kbit/s or half rate channels with 8 kbit/s) is automatically derived from the *Traffic Type* setting where the latter leaves no ambiguity. Otherwise (e.g. for *CS Data TCH/F4.8,* which may be a half rate or a full rate data channel), the scan will not be successful if the wrong *Sub Channel* type is selected. If *16 kBit / 8 dBit* is set, the scan searches for both sub channel types.

Remote control
`CONFigure:ABIS:STARtvalues:PCMTimeslot <numeric>`
`CONFigure:ABIS:STARtvalues:SUBChannel S168 | S16K | S8K`

TCH Channel Type

The *TCH Ch. Type* softkey is located in the left softkey bar of the *Signalling* tab in the *Connection Control* menu:

TCH Chan. Type

The *TCH Chan. Type* softkey defines the coding scheme and the transmission rate in the BTS traffic channel.

The following options are provided:

Speech TCH/FS	Standard full rate speech coding
Speech TCH/EFS	Enhanced full rate speech coding
Speech TCH/HS	Half rate speech coding
CS Data TCH/F14.4	Full rate data with a transmission rate of 14 400 baud
CS Data TCH/F9.6	Full rate data with a transmission rate of 9 600 baud
CS Data TCH/F4.8	Full rate data with a transmission rate of 4 800 baud
CS Data TCH/H4.8	Half rate data with a transmission rate of 4 800 baud
CS Data TCH/H2.4	Half rate data with a transmission rate of 2 400 baud
ECSD E-TCH/F43.2NT	Extended full rate data (EDGE) at 43 200 baud
PDTCH / CS-1	Packet traffic channels coded according to coding scheme 1 *(CS-1)* specified for GPRS.
...	
PDTCH / CS-4	Coding scheme 4 *(CS-4)* specified for GPRS.
PDTCH / MCS-1	Modulation and coding scheme 1 *(MCS-1)* specified for EGPRS.
...	
PDTCH / MCS-4	Modulation and coding scheme 9 *(MCS-9)* specified for EGPRS.

Note: *The* ECSD E-TCH/F43.2NT *channel type must be used for all 8PSK measurements.*

Remote control `CONFigure:BSSignal:TCH:CHTYpe <Type>`

The four coding schemes CS-1 to CS-4 are defined for the GPRS packet data traffic channels (PDTCH). For most packet control channels, coding scheme CS-1 is used. All coding schemes CS-1 to CS-4 are mandatory for MSs supporting GPRS.

The nine modulation and coding schemes MCS-1 to MCS-9 are defined for the EGPRS packet data traffic channels. For all EGPRS packet control channels the corresponding GPRS control channel coding is used. Mobiles supporting EGPRS shall support MCS-1 to MCS-9 in downlink and MCS-1 to MCS-4 in uplink.

GSM850 Tests (Option CMU-K34)

GSM850 tests are included in firmware versions V2.92 and higher. All measurements are identical with the measurements in the other GSM bands. The default settings for the limits and limit lines are the same as for GSM900. In the GSM850 function groups, the following default channel settings are used:

Non Signalling, RF generator frequency:	837.0 MHz (channel 192)
Non Signalling, RF analyzer frequency:	882.0 MHz (channel 192)
Signalling, TCH:	837.0 MHz (channel 192)
Signalling, CCCH:	831.0 MHz (channel 162)

Abis BER Tests – Remote Control

Abis BER measurements are available in *Signalling* mode only. The ABIS interface is configured with the commands of the `ABIS:..` subsystem. Abis BER tests are performed with the commands of the `RXQualtiy:ABIS:...` subsystem.

Connection Control

The remote-control commands presented in this section control the signalling (call setup and cleardown, services, signalling parameters), determine the RF inputs and outputs and the reference frequency and configure the Abis interface. They correspond to the settings in the popup menu of the softkey *Connect. Control* located to the right of the headline of each main menu.

Abis Interface – Subsystem ABIS

The subsystem *ABIS* configures the Abis interface of the CMU. It corresponds to the *Abis* tab in the popup menu *Connect. Control*.

CONFigure:ABIS:IMODe *<Mode>*				Interface Mode
<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
E1DF |	Double frame	E1CR	–	–
E1CRc4mf |	CRC4 multiframe			
T1SF |	Standard frame			
T1ESf |	Extended standard frame			
T1CRc6esf	CRC6 extended standard frame			
Description of command			Sig. State	FW vers.
This command selects one of the supported Abis link protocols.			all	V2.82

CONFigure:ABIS:TTYPe *<Type>*				Traffic Type
<Type>	Description of parameters	Def. value	Def. unit	Unit ring
TTFR |	Standard full rate speech coding	TTFR	–	–
TTEFr |	Enhanced full rate speech coding			
TTHR |	Half rate speech coding			
TF14 |	Full rate data with a transmission rate of 14 400 baud			
TF96 |	Full rate data with a transmission rate of 9 600 baud			
TF48	Half rate or full rate data with a transmission rate of 4 800 baud			
Description of command			Sig. State	FW vers.
This command selects the coding scheme and the transmission rate in the BTS traffic channel transferred via Abis interface.			all	V2.82

CONFigure:ABIS:PCMTimeslot <*Slot_No*> PCM Time Slot

<*Slot_No*>	Description of parameters	Def. value	Def. unit	Unit ring
1 to 31	Time slot number	16	–	–
Description of command			Sig. State	FW vers.
This command selects the timeslot for the PCM (Pulse Code Modulation) traffic channel signal. The range of time slot numbers is restricted to 1 to 24 if a T1 link protocol is selected; see `CONFigure:ABIS:IMODe` command.			all	V2.82

CONFigure:ABIS:TSBitno <*Bit_No*> Time Slot Bit No.

<*Bit_No*>	Description of parameters	Def. value	Def. unit	Unit ring
BN01 | BN23 | BN45 | BN67 |	Time slot pair for full rate channels	BN01	–	–
BNR0 to BNR7	Time slot for half rate channels			
Description of command			Sig. State	FW vers.
This command selects the bit numbers within the PCM timeslot that define a full rate or half rate channel; see `CONFigure:ABIS:TTYPe` command.			all	V2.82

CONFigure:ABIS:STARtvalues:PCMTimeslot <*Slot_No*> Start Values: PCM Time Slot

<*Slot_No*>	Description of parameters	Def. value	Def. unit	Unit ring
1 to 31	Time slot number	16	–	–
Description of command			Sig. State	FW vers.
This command sets a start value for the *PCM Time Slot*. The scan routine (see section *Scan – Subsystem ABIS:SCAN* on page 10) searches from the *PCM Time Slot* defined with the *Start Values* softkey upwards.			all	V2.82

CONFigure:ABIS:STARtvalues:SUBChannel <*Type*> Start Values: Sub Channel

<*Type*>	Description of parameters	Def. value	Def. unit	Unit ring
S16K |	Full rate sub channel (data rate 16 kbit/s)	S16K	–	–
S8K |	Half rate sub channel (data rate 8 kbit/s)			
S168	Search for both sub channel types			
Description of command			Sig. State	FW vers.
This command defines whether the *Scan* (see section *Scan – Subsystem ABIS:SCAN* on page 10) searches for a full rate or half rate sub channel.			all	V2.82

Scan – Subsystem ABIS:SCAN

The subsystem *ABIS:SCAN* controls the automatic search for the sub channel times slot and bit number on the Abis interface. It corresponds to the Scan softkey in the *Abis* tab of the popup menu *Connect. Control*. The results of the scan can be queried by means of the commands `CONFigure:ABIS:PCMTimeslot` and `CONFigure:ABIS:TSBitno`.

INITiate:ABIS:SCAN **ABORt:ABIS:SCAN**	Start scan, reserve resources Switch off scan, release resources	*RUN* *OFF*
Description of command		FW vers.
These commands have no query form. They start and stop the scan, setting it to the status given in the top right column.		V2.82

FETCh:ABIS:SCAN:STATus?				Scan Status
Return	Description of parameters	Def. value	Def. unit	Unit ring
OFF | **RUN |** **ERR**	Scan switched off (`ABORt` or `*RST`) Running (`INITiate`) Switched off (could not be started)	OFF	–	–
Description of command				FW vers.
This command is always a query. It returns the current scan status.				V2.82

Scan – Subsystem ABIS:ALARmmonitor

The subsystem *ABIS:ALARMMONITOR* controls the alarm monitor on the Abis interface. It corresponds to the *Alarm Monitor* softkey and the *Alarms* output table in the *Abis* tab of the popup menu *Connect. Control*.

INITiate:ABIS:ALARmmonitor **ABORt:ABIS:ALARmmonitor**	Start alarm monitor, reserve resources Switch off ALARmmonitor, release resources	*RUN* *OFF*
Description of command		FW vers.
These commands have no query form. They start and stop the alarm monitor, setting it to the status given in the top right column.		V2.82

FETCh:ABIS:ALARmmonitor:STATus?				Alarm Monitor Status
Returned values	Description of parameters	Def. value	Def. unit	Unit ring
OFF | **RUN |** **ERR**	Alarm monitor switched off (`ABORt` or `*RST`) Running (`INITiate`) Switched off (could not be started)	OFF	–	–
Description of command				FW vers.
This command is always a query. It returns the current status of the alarm monitor.				V2.82

SENSe:ABIS:ALARmmonitor?				Alarms
Returned values	Description of parameters	Def. value	Def. unit	Unit ring
NACT | ACT | NAPP,	Indicator for alarm type *No Signal*	NACT	–	–
NACT | ACT | NAPP,	Indicator for alarm type *AIS*	NACT	–	–
NACT | ACT | NAPP,	Indicator for alarm type *No Synchronization*	NACT	–	–
NACT | ACT | NAPP	Indicator for alarm type *No CRC*	NACT	–	–
Description of command				FW vers.
This command is always a query. It returns the current result of the alarm monitor analysis. The three indicators show that an alarm event is not active *(NACT)*, active *(ACT)* or not applicable *(NAPP*, this is returned for the alarm type *No CRC* if none of the CRC interface modes is active; see `CONFigure:ABIS:IMODe` command).				V2.82

Test Object RXQuality:ABIS:BER

The subsystem *RXQuality:ABIS:BER* measures the receiver quality via Abis interface in the single shot mode. The subsystem corresponds to the main menu *Receiver Quality*, application *BER CMU* and the corresponding parts of the associated popup menu *Receiver Quality Configuration.*

Control of Measurement – Subsystem RXQuality:ABIS:BER

The subsystem *RXQuality:ABIS:BER* controls the single shot receiver quality measurements via Abis interface.

CONFigure:RXQuality:ABIS:BER:TSETup <*Testsetup*> Test Setup

<Application>	Description of parameters	Def. value	Def. unit	Unit ring
T1 | **T2 |** **...** **T10**	Single Shot Test Setup 1 ... Single Shot Test Setup 10	T1	–	–

Description of command	Sig. State	FW vers.
This command selects one out of 10 data sets as application, enabling 10 different single shot *Receiver Quality* measurements that can be parameterized. When an application is switched over, the running measurement is stopped and all measured values are set invalid.	CEST	V2.82

INITiate:RXQuality:ABIS:BER	Start new measurement	*RUN*
ABORt:RXQuality:ABIS:BER	Abort running measurement and switch off	*OFF*
STOP:RXQuality:ABIS:BER	Stop measurement	*STOP*
CONTinue:RXQuality:ABIS:BER	Next measurement step (only *stepping mode*)	*RUN*

Description of command	Sig. State	FW vers.
These commands do not exist as queries. They start or stop one the selected single shot measurement, setting it to the status indicated in the top right column.	all	V2.82

CONFigure:RXQuality:ABIS:BER:EREPorting <*Mode*> Event Reporting

<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
SRQ | **SOPC |** **SRSQ |** **OFF**	Service request Single operation complete SRQ and SOPC No reporting	OFF	–	–

Description of command	Sig. State	FW vers.
This command defines the events generated when the measurement is terminated or stopped *(event reporting*, see chapter 5).	all	V2.82

FETCh:RXQuality:ABIS:BER:STATus?				Measurement Status
Return	Description of parameters	Def. value	Def. unit	Unit ring
OFF |	Measurement in the *OFF* state (`*RST` or `ABORt`)	OFF	–	–
RUN |	Running (after `INITiate, CONTinue` or `READ`)			
STOP |	Stopped (`STOP`)			
ERR |	*OFF* (could not be started)			
STEP |	Stepping mode *(<stepmode>=STEP)*			
RDY,	Stopped according to repetition mode and stop condition			
1 to 50000 |	Counter for current evaluation period within a cycle			
NONE	Statistic count set to off	NONE	–	–
Description of command			Sig. State	FW vers.
This command is always a query. It returns the status of the measurement (see chapter 5).			all	V2.82

Subsystem RXQuality:ABIS:BER:CONTrol

The subsystem *RXQuality:ABIS:BER:CONTrol* sets the parameters for the single shot *Receiver Quality* measurement via Abis interface. The subsystem corresponds to the tab *Control* in the popup menu *Receiver Quality Configuration.*

CONFigure:RXQuality:ABIS:BER<nr>:CONTrol *<Mode>, <FramesToSend>*				Frames
<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
RFER |	Residual bit error rate, FER	RFER	–	
BER	Bit error rate			
<FramesToSend>	Description of parameters	Def. value	Def. unit	Unit ring
1 to 50000 |	No. of frames to be sent in single shot mode	See below	–	
NONE	No average (only 1 frame considered)			
Description of command			Sig. State	FW vers.
This command defines the measured value and the number of frames to be sent in a single shot measurement, constituting a statistics cycle. The suffix <nr> numbers the test setup (<nr> = 1 to 10, see command `CONFigure:RXQuality:ABIS:BER:TSETup`). For a definition of the measured values (BER, RBER etc.) see chapter 4. The following default settings are valid for the command parameters:			all	V2.82

Test setup	1	2	3	4	5	6	7	8	9	10
Mode	BER	BER	BER	BER	BER	BER	BER	BER	BER	BER
Frames	100	100	500	500	100	500	500	100	100	100

CONFigure:RXQuality:ABIS:BER<nr>:CONTrol:REPetition *<StopCondition>* ,<Stepmode>Test Cycles

<StopCondition>	Description of parameters	Def. value	Def. unit	Unit ring
ALIMits |	Measurement aborted when all permissible limit values are violated	See below	–	–
FLIMit |	Aborted when first limit value is violated			
NONE	Not aborted, measurement over all frames			

<Stepmode>	Description of parameters	Def. value	Def. unit	Unit ring
STEP |	Interrupt measurement after each statistics cycle	NONE	–	–
NONE	Continue measurement according to its rep. mode			

Description of command	Sig. State	FW vers.
This command determines the stop condition and the stepping mode for the measurement. The suffix <nr> numbers the test setup (<nr> = 1 to 10, see command `CONFigure:RXQuality:ABIS:BER:TSETup`). Depending on the application, the following default settings are valid:	all	V2.82

Test setup	1	2	3	4	5	6	7	8	9	10
StopCond	FLIM	FLIM	FLIM	FLIM	FLIM	FLIM	FLIM	FLIM	FLIM	FLIM

CONFigure:RXQuality:ABIS:BER<nr>:CONTrol:TCH:LEVel:UTIMeslot *<Level>*

TCH BER Level, Used Timeslot

<Level>	Description of parameters	Def. value	Def. unit	Unit ring
–137 dBm to –27 dBm	RF1 level in used timeslot	See below	dBm	Power level
–137 dBm to –10 dBm	RF2 level in used timeslot			
–90 dBm to +13 dBm	RF3 OUT level in used timeslot			

Description of command	Sig. State	FW vers.
This command defines the absolute level of the traffic channel (*TCH*) in the used timeslot for the single shot receiver quality measurement.	all	V2.82

This level applies to the Receiver Quality measurement only. The default setting depends on the test setup (<nr> = 1 to 10; all level values in dBm):

Test setup	1	2	3	4	5	6	7	8	9	10
Level	–102.0	–104.0	–102.0	–104.0	–100.0	–100.0	–100.0	–102.0	–102.0	–102.0

CONFigure:RXQuality:ABIS:BER<nr>:CONTrol:TCH:LEVel:UNTimeslot *<Level>*

TCH BER Level, Unused Timeslot

<Level>	Description of parameters	Def. value	Def. unit	Unit ring
–127 dB to +127 dB	Level in unused timeslot	see below	dB	Ratio

Description of command	Sig. State	FW vers.
This command defines the relative level of the traffic channel (*TCH*) in the unused timeslot for the single shot receiver quality measurement.	all	V2.82

This level applies to the *receiver quality* measurement only. The value range mentioned above is valid with the restriction that the sum of the absolute level of the used timeslot and the relative value for the unused timeslot does not exceed the value ranges for the absolute level of the used timeslot (for RF 1, RF 2 and RF 3 OUT).The default setting depends on the test setup (<nr> = 1 to 10; all level values in dB):

Test setup	1	2	3	4	5	6	7	8	9	10
Level	–18.0	–16.0	–18.0	–16.0	–20.0	–20.0	–20.0	–18.0	–18.0	–20.0

DEFault:RXQuality:ABIS:BER<nr>:CONTrol <Enable>				Default Settings
<Enable>	Description of parameters	Def. value	Def. unit	Unit ring
ON |	All parameters are set to their default values	ON	–	
OFF	Some or all parameters differ from the default values			
Description of command			Sig. State	FW vers.
If used with *ON*, this command sets all the parameters of the subsystem to their default values. (*OFF* has no effect). In the query format, the command returns *ON* if all the parameters of the subsystem correspond to their default values, otherwise it returns *OFF*.			all	V2.82

Subsystem RXQuality:ABIS:BER<nr>:LIMit

The subsystem *RXQuality:ABIS:BER<nr>:LIMit* defines tolerance values for the single shot receiver quality measurements. The subsystem corresponds to the tab *Limits* in the popup menu *Receiver Quality Configuration*.

CONFigure:RXQuality:ABIS:BER<nr>:LIMit:CLII <*ClassIIBER*>				Class II Bits
<ClassIIBER>	Description of parameters	Def. value	Def. unit	Unit ring
0 % to 100 %	Upper limit of error rate for class II bits	2	%	Ratio
Description of command			Sig. State	FW vers.
This command defines an upper limit for the bit error rate of class II (unprotected bits, see chapter 4) for the current test setup (<nr> = 1 to 10). Irrespective of the test setup, the default setting is 2 %.				V2.82

CONFigure:RXQuality:ABIS:BER<nr>:LIMit:CLIB <*ClassIbBER*>				Class Ib Bits
<ClassIbBER>	Description of parameters	Def. value	Def. unit	Unit ring
0 % to 100 %	Upper limit of error rate for class Ib bits	0.4	%	Ratio
Description of command			Sig. State	FW vers.
This command defines an upper limit for the bit error rate of class IB (partly protected bits, see chapter 4) for the current test setup (<nr> = 1 to 10). Irrespective of the test setup, the default setting is 0.4 %.				V2.82

CONFigure:RXQuality:ABIS:BER<nr>:LIMit:FERRors <Frame Errors>				Frame Errors
<FERRors>	Description of parameters	Def. value	Def. unit	Unit ring
0 % to 100 %	Upper limit for erased frame errors	0.1	%	Ratio
Description of command			Sig. State	FW vers.
This command defines an upper limit for frame errors for the current test setup (<nr> = 1 to 10) . Irrespective of the test setup, the default setting is 0.1 %.				V2.82

DEFault:RXQuality:ABIS:BER<nr>:LIMit				Default Settings
<Enable>	Description of parameters	Def. value	Def. unit	Unit ring
ON | **OFF**	All parameters are set to their default values Some or all parameters differ from the default values	ON	–	
Description of command			Sig. State	FW vers.
If used with *ON*, this command sets all the parameters of the subsystem to their default values. (*OFF* has no effect). In the query format, the command returns *ON* if all the parameters of the subsystem correspond to their default values, otherwise it returns *OFF*.			all	V2.82

Measured Values – Subsystem RXQuality:ABIS:BER

The subsystem *RXQuality:ABIS:BER* measures the bit error rate and compares it with the tolerance values. The subsystem corresponds to the measurement menus *Receiver Quality* in the *BER* application.

Scalar Results:

READ[:SCALar]:RXQuality:ABIS:BER? Start single shot measurement and return results
FETCh[:SCALar]:RXQuality:ABIS:BER? Read out meas. results (unsynchronized)
SAMPle[:SCALar]:RXQuality:ABIS:BER? Read out measurement results (synchronized)

Return for RFER	Value range	Def. value	Def. unit	Unit ring
ProgressTime,	0.0 to 100.0 %	NAN	%	
ClassIIBits,	0.000 to 100.000 %	NAN	%	
ClassIbBits,	0.000 to 100.000 %	NAN	%	
FER,	0.000 to 100.000 %	NAN	%	
Status	INV | PASS | FAIL | TMER | IMP	INV	–	
Return for BER	Value range	Def. value	Def. unit	Unit ring
ProgressTime,	0.0 to 100.0 %	NAN	%	
ClassIIBits,	0.000 to 100.000 %	NAN	%	
ClassIbBits,	0.000 to 100.000 %	NAN	%	
Status	INV | PASS | FAIL | TMER | IMP	INV	–	
Description of command			Sig. State	FW vers.
These commands are always queries. They start a bit-error-rate test in the single shot repetition mode and output the measurement results (see also detailed explanation of measured values in chapter 4). The results depend on the measurement mode set via the `CONFigure:RXQuality:ABIS:BER<nr>:CONTrol` command (RFER or BER). They are			all	V2.82

ProgressTime	Relative progress of the measurement
ClassIIBits	(Residual) bit error rate for class II bits
ClassIbBits	(Residual) bit error rate for class Ib bits
FER	Frame erasure rate
Status	Measurement status

The following messages can be output for the measurement status:

INV	Measurement invalid	*invalid*
PASS	all tolerances matched	*passed*
FAIL	Not all tolerances matched	*failed*
TMER	CMU could not synchronize	*too many errors*
IMP	Measurement impossible, therefore invalid	*impossible*

CALCulate:RXQuality:ABIS:BER:MATChing:LIMit?				Limit Matching
Return for RFER	Value range	Def. value	Def. unit	Unit ring
Total, **ClassIIBits,** **ClassIbBits,** **FER**	PASS | FAIL | INV | TMER | IMP NMAU | INV | OK NMAU | INV | OK NMAU | INV | OK	INV INV INV INV	– – – –	
Return for BER	Value range	Def. value	Def. unit	Unit ring
Total, **ClassIIBits,** **ClassIbBits**	PASS | FAIL | INV | TMER | IMP NMAU | INV | OK NMAU | INV | OK	INV INV INV	– – –	
Description of command			Sig. State	FW vers.
This command is always a query. It indicates whether and in which way the permissible error limits for the measured values of the bit error rate test (see command above) have been exceeded.			all	V2.82

The following messages can be output for the measured quantities:

PASS	all tolerances matched	*passed*
FAIL	Not all tolerances matched	*failed*
INV	Invalid measurement	*invalid*
TMER	CMU could not synchronize	*too many errors*
IMP	Measurement impossible, therefore invalid	*impossible*
NMAU	Tolerance exceeded	*not matching, underflow*
INV	Invalid measurement	*invalid*
OK	all tolerances matched	

Test Object RXQuality:ABIS:BAVerage

The subsystem *RXQuality:ABIS:BAVerage* contains the commands for continuous receiver quality measurement via Abis interface. The subsystem corresponds to the main menu *Receiver Quality,* Application *BER Abis Average* and the corresponding parts of the associated popup menu *Receiver Quality Configuration.*

Control of Measurement – Subsystem RXQuality:ABIS:BAVerage

The subsystem *RXQuality:ABIS:BAVerage* controls the continuous *Receiver Quality* measurement via Abis interface.

INITiate:RXQuality:ABIS:BAVerage	Start new measurement	*RUN*
ABORt:RXQuality:ABIS:BAVerage	Abort running measurement and switch off	*OFF*
STOP:RXQuality:ABIS:BAVerage	Stop measurement	*STOP*
CONTinue:RXQuality:ABIS:BAVerage	Next measurement step (only *stepping mode*)	*RUN*

Description of command	Sig. State	FW vers.
These commands do not exist as queries. They start or stop the Continuous measurement, setting it to the status indicated in the top right column.	all	V2.82

CONFigure:RXQuality:ABIS:BAVerage:EREPorting <*Mode*> Event Reporting

<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
SRQ |	Service request	OFF	–	–
SOPC |	Single operation complete			
SRSQ |	SRQ and SOPC			
OFF	No reporting			

Description of command	Sig. State	FW vers.
This command defines the events generated when the measurement is terminated or stopped *(event reporting,* see chapter 5).	all	V2.82

FETCh:RXQuality:ABIS:BAVerage:STATus? Measurement Status

Return	Description of parameters	Def. value	Def. unit	Unit ring
OFF |	Measurement in the *OFF* state (`*RST` or `ABORt`)	OFF	–	–
RUN |	Running (after `INITiate, CONTinue` or `READ`)			
STOP |	Stopped (`STOP`)			
ERR |	*OFF* (could not be started)			
STEP |	Stepping mode *(<stepmode>=STEP)*			
RDY,	Stopped according to repetition mode and stop condition			
1 to 500 |	Counter for current evaluation period within a cycle			
NONE	Statistic count set to off	NONE	–	–

Description of command	Sig. State	FW vers.
This command is always a query. It returns the status of the measurement (see chapter 5).	all	V2.82

Subsystem RXQuality:ABIS:BAVerage:CONTrol

The subsystem *RXQuality:ABIS:BAVerage:CONTrol* sets the parameters for the continuous receiver quality measurement. The subsystem corresponds to the tab *Control* in the popup menu *Receiver Quality Configuration.*

CONFigure:RXQuality:ABIS:BAVerage:CONTrol <*Mode*>, <*FramesToAverage*> Average

<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
RFER |	Residual bit error rate, FER	BER	–	
BER	Bit error rate			
<FramesToAverage>	Description of parameters	Def. value	Def. unit	Unit ring
1 to 500 |	No. of frames to be averaged	100	–	
NONE	No average (only 1 frame considered)			

Description of command	Sig. State	FW vers.
This command defines the measured value and the number of frames to be averaged in the continuous measurement, constituting a statistics cycle. For definition of the measured value (BER, RFER etc.) see chapter 4.	all	V2.82

CONFigure:RXQuality:ABIS:BAVerage:CONTrol:REPetition <*StopCondition*> ,<Stepmode> Test Cycles

<StopCondition>	Description of parameters	Def. value	Def. Unit	Unit ring
ALIMits |	Measurement aborted when all permissible limit values are violated	FLIM	–	–
FLIMit |	Aborted when first limit value is violated			
NONE	Not aborted, measurement over all frames			
<Stepmode>	Description of parameters	Def. value	Def. Unit	Unit ring
STEP |	Interrupt measurement after each statistics cycle	NONE	–	–
NONE	Continue measurement according to its rep. mode			

Description of command	Sig. State	FW vers.
This command determines the stop condition and the stepping mode for the measurement. In search mode, an RF level that leads to a particular bit error rate is repeatedly determined.	all	V2.82

CONFigure:RXQuality:ABIS:BAVerage:CONTrol:TCH:LEVel:UTIMeslot <*Level*> TCH BER Level, Used Timeslot

<Level>	Description of parameters	Def. value	Def. unit	Unit ring
–137 dBm to –27 dBm	RF1 level in used timeslot	–102.0	dBm	
–137 dBm to –10 dBm	RF2 level in used timeslot	–102.0	dBm	
–90 dBm to +13 dBm	RF 3 OUT level in used timeslot	–90.0	dBm	

Description of command	Sig. State	FW vers.
This command defines the absolute level of the traffic channel (*TCH*) in the used timeslot for the continuous application. This level applies to the *Receiver Quality* measurement only.	all	V2.82

CONFigure:RXQuality:ABIS:BAVerage:CONTrol:TCH:LEVel:UNTimeslot *<Level>*
TCH BER Level, Unused Timeslot

<Level>	Description of parameters	Def. value	Def. unit	Unit ring
–127 dB to +127 dB	Level in unused timeslot	–18.0	dB	Ratio

Description of command	Sig. State	FW vers.
This command defines the relative level of the traffic channel (*TCH*) in the unused timeslot for the continuous application. This level applies to the Receiver Quality measurement only. The value range mentioned above is valid with the restriction that the sum of the absolute level of the used timeslot and the relative value for the unused timeslot does not exceed the value ranges for the absolute level of the used timeslot (for RF 1, RF 2 and RF 3 OUT).	all	V2.82

DEFault:RXQuality:ABIS:BAVerage:CONTrol
Default Settings

<Enable>	Description of parameters	Def. value	Def. unit	Unit ring
ON |	All parameters are set to their default values	ON	–	
OFF	Some or all parameters differ from the default values			

Description of command	Sig. State	FW vers.
As a *setting command* with the setting *ON* this command sets all parameters of the subsystem to default values (the setting *OFF* has no effect). As a query, this command reads out whether all parameters are set to default values *(ON)* or not *(OFF)*.	all	V2.82

Subsystem RXQuality:ABIS:BAVerage:LIMit

The subsystem *RXQuality:ABIS:BAVeraget:LIMit* defines tolerance values for the continuous receiver quality measurement via Abis interface. The subsystem corresponds to the tab *Limits* in the popup menu *Receiver Quality Configuration.*

CONFigure:RXQuality:ABIS:BAVerage:LIMit:CLII *<ClassIIBER>*
Class II Bits

<ClassIIBER>	Description of parameters	Def. value	Def. unit	Unit ring
0 % to 100 %	Upper limit of error rate for class II bits	2	%	Ratio

Description of command	Sig. State	FW vers.
This command defines an upper limit for the bit error rate of class II (unprotected bits, see chapter 4) for continuous application.		V2.82

CONFigure:RXQuality:ABIS:BAVerage:LIMit:CLIB *<ClassIbBER>*
Class Ib Bits

<ClassIbBER>	Description of parameters	Def. value	Def. unit	Unit ring
0 % to 100 %	Upper limit of error rate for class Ib bits	0.4	%	Ratio

Description of command	Sig. State	FW vers.
This command defines an upper limit for the bit error rate of class IB (partly protected bits, see chapter 4) for the continuous application.		V2.82

CONFigure:RXQuality:ABIS:BAVerage:LIMit:FERRors <Frame Errors> Frame Errors

<FERRors>	Description of parameters	Def. value	Def. unit	Unit ring
0 % to 100 %	Upper limit for erased frame errors	0.1	%	Ratio

Description of command	Sig. State	FW vers.
This command defines an upper limit for the relative portion of invalid and therefore erased frames (*frame erasure rate*, see chapter 4) in the measurement of the residual bit error rate (*RFER*, see command `CONFigure:RXQuality:ABIS:BAVerage:CONTrol`) and for the continuous application.		V2.82

DEFault:RXQuality:ABIS:BAVerage:LIMit
Default Settings

<Enable>	Description of parameters	Def. value	Def. unit	Unit ring
ON |	All parameters are set to their default values	ON	–	
OFF	Some or all parameters differ from the default values			

Description of command	Sig. State	FW vers.
If used with *ON*, this command sets all the parameters of the subsystem to their default values. (*OFF* has no effect). In the query format, the command returns *ON* if all the parameters of the subsystem correspond to their default values, otherwise it returns *OFF*.	all	V2.82

Measured Values – Subsystem RXQuality:ABIS:BAVerage

The subsystem *RXQuality:ABIS:BAVerage* measures the bit error rate and compares it with the tolerance values. The subsystem corresponds to the measurement menus *Receiver Quality* for the single shot type of measurement and measured values *(RFER, BER, BurstByBurst)*.

Scalar Results:

READ[:SCALar]:RXQuality:ABIS:BAVerage? Start single shot measurement and return results
FETCh[:SCALar]: RXQuality:ABIS:BAVerage? Read out meas. results (unsynchronized)
SAMPle[:SCALar]: RXQuality:ABIS:BAVerage? Read out measurement results (synchronized)

Return for RFER	Value range	Def. value	Def. unit	Unit ring
ProgressTime,	0.0 to 100.0 %	NAN	%	
ClassIIBits,	0.000 to 100.000 %	NAN	%	
ClassIbBits,	0.000 to 100.000 %	NAN	%	
FER,	0.000 to 100.000 %	NAN	%	
Status	INV | PASS | FAIL | TMER | IMP	INV	–	
Return for BER	Value range	Def. value	Def. unit	Unit ring
ProgressTime,	0.0 to 100.0 %	NAN	%	
ClassIIBits,	0.000 to 100.000 %	NAN	%	
ClassIbBits,	0.000 to 100.000 %	NAN	%	
Status	INV | PASS | FAIL | TMER | IMP	INV	–	

Description of command	Sig. State	FW vers.
These commands are always queries. They start a bit-error-rate test in the continuous repetition mode and output the measurement results (see also detailed explanation of measured values in chapter 4). These are	all	V2.82

ProgressTime	Relative progress of the measurement
ClassIIBits	(Residual) bit error rate for class II bits
ClassIbBits	(Residual) bit error rate for class Ib bits
FER	Frame erasure rate
Status	Measurement status

The following messages can be output for the measurement status:

INV	Measurement invalid	*invalid*
PASS	all tolerances matched	*passed*
FAIL	Not all tolerances matched	*failed*
TMER	CMU could not synchronize	*too many errors*
IMP	Measurement impossible, therefore invalid	*impossible*

CALCulate:RXQuality:ABIS:BAVerage:MATChing:LIMit? Limit Matching

Return for RFER	Value range	Def. value	Def. unit	Unit ring
Total,	PASS | FAIL | INV | TMER | IMP	INV	–	
ClassIIBits,	NMAU | INV | OK	INV	–	
ClassIbBits,	NMAU | INV | OK	INV	–	
FER	NMAU | INV | OK	INV	–	
Return for BER	**Value range**	**Def. value**	**Def. unit**	**Unit ring**
Total,	PASS | FAIL | INV | TMER | IMP	INV	–	
ClassIIBits,	NMAU | INV | OK	INV	–	
ClassIbBits	NMAU | INV | OK	INV	–	

Description of command	Sig. State	FW vers.
This command is always a query. It indicates whether and in which way the permissible error limits for the measured values of the bit error rate test (see command above) have been exceeded.	all	V2.82

The following messages can be output for the measured quantities:

PASS	all tolerances matched	*passed*
FAIL	Not all tolerances matched	*failed*
INV	Invalid measurement	*invalid*
TMER	CMU could not synchronize	*too many errors*
IMP	Measurement impossible, therefore invalid	*impossible*
NMAU	Tolerance exceeded	*not matching, underflow*
INV	Invalid measurement	*invalid*
OK	all tolerances matched	

TCH Channel Type – Remote Control

The parameter list of the command selecting the traffic channel type has been extended:

CONFigure:BSSignal:TCH:CHTYpe ***<Type>***				Channel Type
<Type>	Description of parameters	Def. value	Def. unit	Unit ring
FRATe |	Standard full rate speech coding	TCHFR	-	–
EFRate |	Enhanced full rate speech coding			
E432 |	TCH Edge 432			
HRATe |	TCH half rate speech coding			
FD144 |	Full rate data 14400 Baud			
FD96 |	Full rate data 9600 Baud			
FD48 |	Full rate data 4800 Baud			
HD48 |	Half rate data 4800 Baud			
HD24 |	Half rate data 2400 Baud			
EGC1	Extended full rate data (EDGE) at 43 200 baud			
CS1 |	GPRS coding scheme 1 (CS-1)			
...	...			
CS4 |	GPRS coding scheme 4 (CS-4)			
MCS1 |	EGPRS modulation and coding scheme 1 (MCS-1)			
...	...			
MCS9	EGPRS modulation and coding scheme 9 (MCS-9)			

Description of command	Sig. State	FW vers.
This command determines the speech coding and transmission rate in the traffic channel. The GPRS and EGPRS coding schemes are available in FW version V2.82 and higher.	all	V2.80

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1 Installation and First Steps 1.1

Software Installation or Update 1.1

Enabling Software Options 1.2

1 Installation and First Steps

This chapter describes how to enable, to install or update the firmware containing the software options *GSM900/1800/1900-BTS* for the Universal Radio Communication Tester CMU.

Before proceeding to perform any of the steps described in this manual, please make sure that the instrument is properly connected and put into operation according to the instructions given in chapter 1 of the CMU manual. The hardware and software options available are shown in the *Startup* menu. The status of the software options required for GSM base station tests is indicated in the lines "CMU-K30 GSM400-BTS", "CMU-K31 GSM900-BTS", "CMU-K32 GSM1800-BTS", and "CMU-K33 GSM1900-BTS". The status of the additional options described in this manual is indicated in the lines "CMU-K39 MOC/MTC" and "CMU-K41 EDGE ":

- If *available* is indicated, the CMU is ready to perform GSM base station tests. In this case you may skip this chapter, except if you wish to update the current software version.
- If *disabled* is indicated, the software option must be enabled.
- If *not available* is indicated, the software must be installed via the PCMCIA interface or the floppy disk drive.

Software Installation or Update

The CMU is always delivered with the latest software version available. New CMU software versions are available for download on the R&S Lotus Notes Service board. To be loaded via the CMU's PCMCIA interface, the software must be copied to one or several flash disks/memory cards or PCMCIA hard disks as explained in the instructions supplied with the software download version. An appropriate memory card CMU-Z1, order no. 1100.7490.02, can be obtained from Rohde & Schwarz.

Note: *If your CMU is equipped with a floppy disk drive (option CMU-U61), a set of installation floppy disks must be generated instead of a flash disk. All other steps do not depend on the storage medium.*

To install the software proceed as follows:

➢ Switch off the CMU.

➢ Insert the flash disk into one of the two slots of the PCMCIA interface.

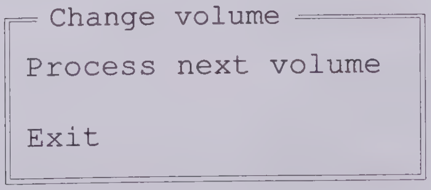
➢ Switch on the CMU.

The installation is started automatically while the CMU performs its start-up procedure. To this end the *VersionManager* is called up.

➢ Use the softkeys on the left side of the display to select the item *Install new software version.*

➢ If more than one version or more than one installation medium is available, use the softkeys again to select the desired version/installation medium.

The installation is started. To indicate that the flash disk must be changed the CMU issues the *Change volume* message:



- Replace the current disk with the disk requested.
- Use the cursor up/down keys to select "Process next volume" (default setting).
- Press *ENTER* to confirm that the new disk has been inserted and to continue the installation.

To monitor the installation process the CMU displays messages such as:

```
...Volume # 1 has been processed
...Volume # 2 to be installed next
```

After processing the last floppy disk the CMU displays the messages:

```
...Installation completed
...please remove the installation media to reboot
...press any key to continue
```

- Remove the disk and press any key to reboot the CMU.

The CMU reboots and performs a firmware update of the hardware modules. This may take a few minutes. Afterwards the new software version is started and the instrument is ready to operate.

For more information on software installation refer to chapter 4 of your CMU service manual instrument.

Enabling Software Options

A new CMU software option purchased is ready to operate after it is enabled by means of a key code supplied with the option. This key code is to be entered into the *Option Enable* popup window which in turn can be opened via from the *Setup – Options* menu. For details refer to Chapter 4 of the CMU operating manual.

Note: *The CMU software is delivered in complete versions containing all software options available. Software installation and enabling of software options are completely independent from each other.*

Contents

2 Getting Started

2 Getting Started.. 2.1

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2 Getting Started

The following chapter presents a sample GSM base station test with the universal radio communication tester CMU. It is intended to provide a quick overview of the function groups *GSM400/900/1800/1900-BTS Non Signalling* and *GSM400/900/1800/1900-BTS Signalling* and to lead through some basic tests that are commonly performed on GSM base stations.

Test that require additional software options, in particular transmitter tests of 8PSK-modulated signals (with option CMU-K41, EDGE for CMU-K30/-K31/-K32/-K33) and setup of a call connection from the CMU or the BTS under test (with option CMU-K39, MOC/MTC) are not described in this chapter. Nevertheless, they are described in detail in the reference parts of this manual; see chapters 4 and 6.

Before starting any measurement with the CMU, please note the instructions given in chapter 1 of the operating manual for the CMU basic unit for putting the instrument into operation. In chapters 2 to 4 of that manual you will also find information on customizing the instrument and the display according to your personal preferences. For installation instructions for the GSM400/900/1800/1900 software (CMU-K30/-K31/-K32/-K33) refer to chapter 1 of the present manual.

The tests reported below include:

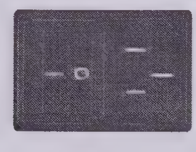
- Connection of the phone and selection of the GSM function group
- Power and modulation measurements in *Non Signalling* mode
- Selection and measurement of signalling parameters
- Receiver Quality tests

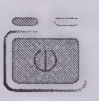
The steps to perform are explained on the left side of each double-page together with the results obtained on the CMU screen. On the right side, additional information is given. We also point out alternative settings and related measurements that could not be reported in detail.

The principles of manual operation are discussed in chapter 3. For a systematic explanation of all menus, functions and parameters including GSM background information refer to the reference part in chapter 4.

Preparing a GSM Base Station Test

This chapter describes how to use the CMU for GSM base station tests. As a prerequisite for starting the session, the instrument must be correctly set up and connected to the AC power supply as described in chapter 1 of the operating manual for the CMU basic unit. Furthermore, the GSM software must be properly installed following the instructions given in chapter 1 of the present manual.

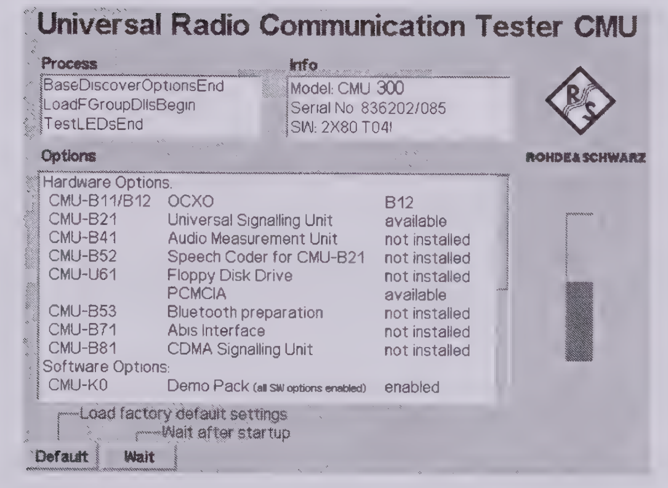




Step 1

- Switch on the CMU using the mains switch at the rear. ①
- Check the operating mode of the instrument at the *ON/STANDBY* key on the front panel.② Press the *ON/STANDBY* key to switch on the CMU.

⇓



Universal Radio Communication Tester CMU

Process

BaseDiscoverOptionsEnd
LoadFGroupDllsBegin
TestLEDsEnd

Info

Model: CMU 300
Serial No: 836202/085
SW: 2X80 T04!

Options

Hardware Options:

CMU-B11/B12	OCXO	B12
CMU-B21	Universal Signalling Unit	available
CMU-B41	Audio Measurement Unit	not installed
CMU-B52	Speech Coder for CMU-B21	not installed
CMU-U61	Floppy Disk Drive	not installed
	PCMCIA	available
CMU-B53	Bluetooth preparation	not installed
CMU-B71	Abis Interface	not installed
CMU-B81	CDMA Signalling Unit	not installed

Software Options:

CMU-K0	Demo Pack (all SW options enabled)	enabled

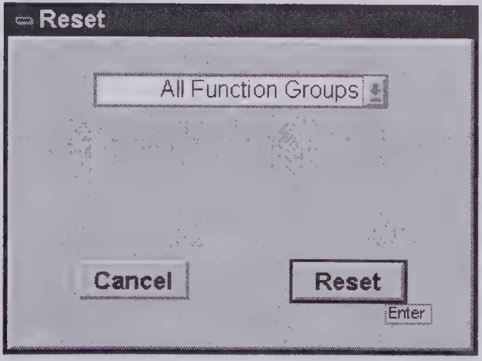
Step 2

The startup menu is displayed while the CMU performs a power-up test. ③

After a few seconds the CMU displays the last menu used in the previous session.

⇓

⇓



Step 3

- Press the *RESET* key to open the *Reset* popup menu.

The *Reset* popup menu is opened.

- Use the left and right arrow keys to toggle between the two buttons *Cancel* and *Reset*.
- Select *Reset* and press the *ENTER* key.
- In the popup window opened *(Are you sure?)*, select *Yes* to confirm the instrument reset.

The CMU indicates that it performs a general reset of all device settings and is then ready to carry out the following steps. The *Reset* popup menu is closed automatically.

Additional Information...

... on Step 1

① **Mains switch on the rear panel**

When the mains switch at the rear is set to the *OFF* position, the complete instrument is disconnected from the power supply. When it is set to the *ON* position, the instrument is in standby mode or in operation, depending on the position of the *ON/STANDBY* key on the front panel.

② ***ON/STANDBY* key on the front panel**

The *ON/STANDBY* key at the front of the instrument determines whether the instrument is in standby mode or in operation.

Standby mode:
Only the reference frequency oscillator is supplied with operating voltage, and the orange LED (STANDBY) is illuminated.

Operation:
The green LED (ON) is illuminated and all modules of the instrument are supplied with operating voltage.

... on Step 2

③ **Startup menu (see p. 2.2)**

The startup menu displays the following information:

- The status of the startup test *(Process)*
- The device name, serial number and software version *(Info)*
- The options and equipment installed *(Options)*
- The progress of the startup test (*Startup* bar graph)

Alternative Settings and Measurements

☞ Chapter 1 of CMU manual

☞ Chapter 1 of CMU manual

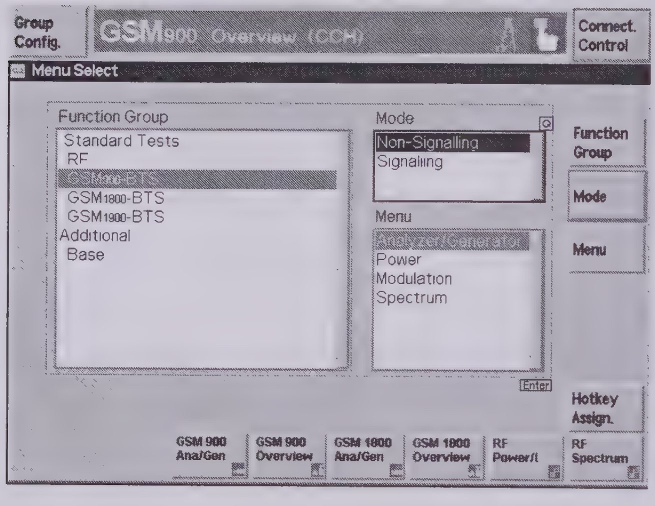
☞ Chapter 4 of CMU manual

That chapter also contains information on customizing the CMU.

MENU
SELECT

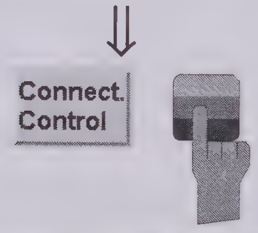
Step 4

- Press the *Menu Select* key to open the *Menu Select* menu.④


Group Config.
GSM900 Overview (CCH)
Connect. Control
Menu Select
Function Group
Standard Tests
RF
GSM900-BTS
GSM1800-BTS
GSM1900-BTS
Additional
Base
Mode
Non-Signalling
Signalling
Menu
Analyzer/Generator
Power
Modulation
Spectrum
Enter
Function Group
Mode
Menu
Hotkey Assign.
GSM 900 Ana/Gen
GSM 900 Overview
GSM 1800 Ana/Gen
GSM 1800 Overview
RF Power/t
RF Spectrum

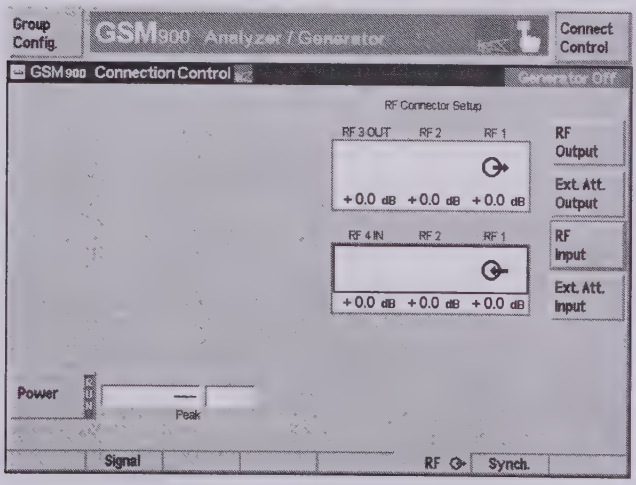
The *Menu Select* menu indicates the function groups available. If a function group is selected the corresponding modes and measurement menus are indicated.

- Select the appropriate *GSMxxx-BTS* function group, xxx corresponding to the GSM hyperband supported by the base station under test.
- Select the *Non-Signalling* mode
- Select the *Analyzer/Generator* menu.
- Press the *Enter* key to activate the measurement selected and open the *Analyzer/Generator* menu.


Connect.
Control

Step 5

- Press the *Connect. Control* softkey.


Group Config.
GSM900 Analyzer / Generator
Connect. Control
GSM900 Connection Control
Generator Off
RF Connector Setup
RF 3 OUT
RF 2
RF 1
+0.0 dB
+0.0 dB
+0.0 dB
RF 4 IN
RF 2
RF 1
+0.0 dB
+0.0 dB
+0.0 dB
RF Output
Ext. Att. Output
RF Input
Ext. Att. Input
Power
Peak
Signal
RF
Synch.

The *RF Connection Control* menu is opened. ⑤

- Press the *RF* ⊖ hotkey to open the index card defining the signal connectors and external attenuations.
- Select RF1 as output connector and as input connector. Do not define any external attenuations (all values equal to 0.0 dB).

Two yellow LEDs on the front panel indicate the input and output connectors selected.

Additional Information...

... on Step 4

④ **Menu Select menu**

The *Menu Select* menu shows all function groups installed on your CMU. Function group *GSM400/900/1800/1900-BS* is subdivided in the two measurement modes *Non Signalling* and *Signalling*, each containing a number of measurement menus.

... on Step 5

⑤ **RF connection of the base station**

The *RF Connection Control* menu configures the input and output connectors in the *GSM900-BS Non Signalling* function group. The CMU provides two bi-directional RF connectors RF1 and RF2 differing by their permissible input and output levels. RF1 is adapted to the RF output level range of a GSM base station; it is the recommended standard connector for GSM-BS tests (see data sheet).

The unidirectional connectors RF4 IN and RF3 OUT are intended for connection of modules requiring high input levels or modules with low RF output levels. RF4 IN and RF3 OUT can also be used to connect GSM base stations off the air via antennas.

The choice of the RF inputs and outputs may also depend on the connectors of your base station.

Alternative Settings and Measurements

☞ Chapter 3

☞ Chapter 4

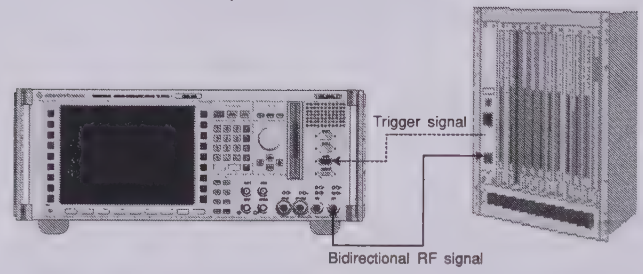
Frequently used measurement menus can be stored together with their function group and mode and assigned to one of the eight hotkeys. When needed for the next time, they can be called up by a single keystroke.

☞ Chapter 4

Input and output connectors can be selected in the *RF* ⊙→ tab of the *Connect. Control* menu; see section *RF Connectors* on page 4.56 ff.

The same tab lets you report external attenuation factors for the RF inputs and outputs of the CMU. This feature can be used to compensate for a known cable loss between the CMU and the BTS under test.

⇓



Step 6

- ➢ Connect the bi-directional RF connector RF 1 of the CMU to the RF input/output of the base station. ⑥
- ➢ Provide an external trigger signal (TTL) at pin no. 6 of connector AUX 3 of the CMU (for wired synchronization only, see section *Synchronization and Signalling Parameters* on p. 2.16 ff). ⑦
- ➢ Supply the base station with the correct operating voltage and switch on.

The CMU is now ready to perform module tests on the base station (see section *Non Signalling Mode* on p. 2.8 ff). To perform synchronized measurements on the CCH or TCH from the base station, the *Menu Select* menu must be called up again to select the *Signalling* mode (see section *Signalling Mode* on p. 2.16 ff).

Additional Information...

... on Step 6

⑥ **RF connection of the base station**

A high-quality cable should be used for this connection, ideally with an attenuation of less than 0.5 dB.

⑦ **External trigger**

In *Signalling* measurements, the CMU is time-synchronized with the base station under test; see section *Synchronization and Signalling Parameters* on page 2.16. The time reference can be provided either by the control channel signal from the BTS fed in via the current RF connector (CCH synchronization) or by an external trigger signal with a TCH multiframe structure that is applied to pin no. 6 of the AUX 3 connector (wired synchronization, multiframe trigger).

For unsynchronized operation *(Non Signalling Mode*, see p. 2.8) or CCH synchronization, only the RF connection between the CMU and the BTS under test is needed.

Alternative Settings and Measurements

☞ Chapter 4

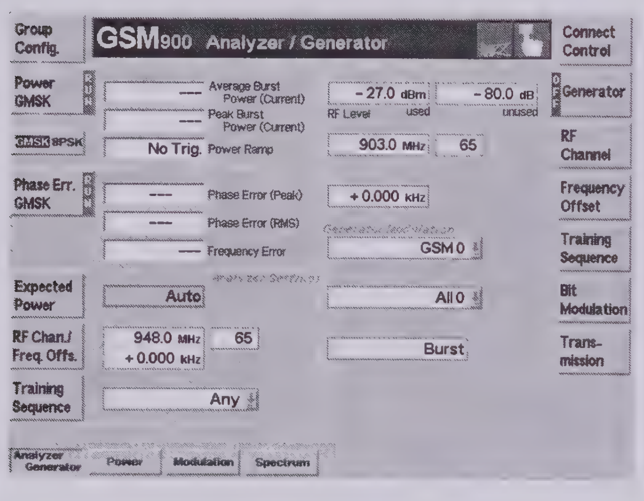
☞ Chapter 4

See section *Signalling Control (State Unsynchronized)* on p. 4.64 ff.

Non Signalling Mode

In the *Non Signalling* mode, a GSM-specific RF signal can be generated and a RF signal with GSM characteristics can be analyzed. Compared to the *Signalling* mode test times may be reduced considerably. Moreover, the measurements are not restricted to the specified channel range of the network. The most common application is module test and test of base stations in a special “test mode”.

In our example we use the GSM signal generated by the CMU itself to demonstrate the main features of the *Non Signalling* mode. This is analogous to the *RF* measurement example in the operating manual for CMU and illustrates the extended functionality of the GSM function groups.


Group Config.
GSM900 Analyzer / Generator
Connect Control
Power GMSK
GMSK 8PSK
Phase Err. GMSK
Expected Power
RF Chan./ Freq. Offs.
Training Sequence
Generator
RF Channel
Frequency Offset
Training Sequence
Bit Modulation
Trans- mission
Analyzer Generator
Power
Modulation
Spectrum

Average Burst Power (Current): ---
Peak Burst Power (Current): ---
Power Ramp: No Trig.
Phase Error (Peak): ---
Phase Error (RMS): ---
Frequency Error: ---
Expected Power: Auto
RF Chan./Freq. Offs.: 948.0 MHz 65 +0.000 kHz
Training Sequence: Any
RF Level: -27.0 dBm used -80.0 dB unused
903.0 MHz 65
+0.000 kHz
Generator Modulation: GSM 0
All 0
Burst

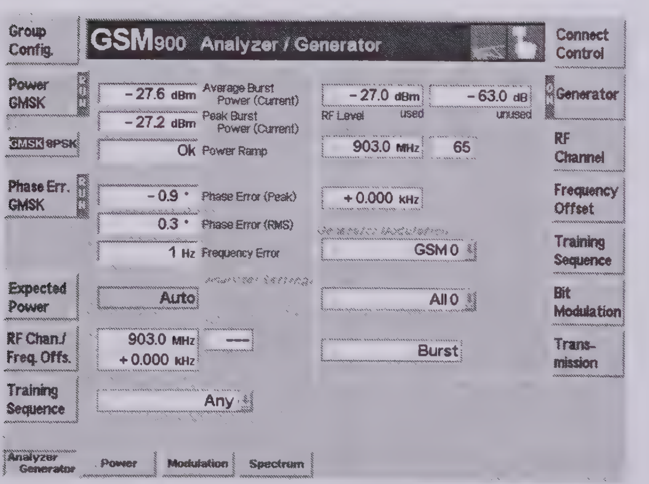
Step 1

The *Analyzer/Generator* menu configures the signals generated by the RF generator of the CMU and sets the RF analyzer.①

In addition, the current measurement results for power, frequency and phase errors of the received signal are displayed. At present, there is no RF input signal so the output fields show invalid results ("---"). ②

All parameters are set to default values. They can be directly changed in the *Analyzer/Generator* menu. User-defined parameters will be saved to the non-volatile RAM for later sessions when the CMU is switched off.

⇓


Group Config.
GSM900 Analyzer / Generator
Connect Control
Power GMSK
GMSK 8PSK
Phase Err. GMSK
Expected Power
RF Chan./ Freq. Offs.
Training Sequence
Generator
RF Channel
Frequency Offset
Training Sequence
Bit Modulation
Trans- mission
Analyzer Generator
Power
Modulation
Spectrum

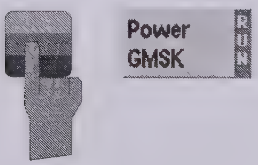
Average Burst Power (Current): -27.6 dBm
Peak Burst Power (Current): -27.2 dBm
Power Ramp: Ok
Phase Error (Peak): -0.9 °
Phase Error (RMS): 0.3 °
Frequency Error: 1 Hz
Expected Power: Auto
RF Chan./Freq. Offs.: 903.0 MHz --- +0.000 kHz
Training Sequence: Any
RF Level: -27.0 dBm used -63.0 dB unused
903.0 MHz 65
+0.000 kHz
Generator Modulation: GSM 0
All 0
Burst

- ➢ Proceed as outlined in section *RF Non Signalling Measurements*, chapter 2 of the CMU operating manual to connect RF3 to RF 4 via a coax cable. Open the *Connection Control* menu and perform the appropriate RF input and output settings.

By default, the *Expected Power* is set to *Auto*, the CMU adapts itself to the power of the RF input signal. ③

- ➢ Adapt the *RF Chan.* setting to the expected input signal frequency.
- ➢ Press the *Generator* softkey and the *ON/OFF* key to switch on the generator.

⇓


Power GMSK
RUN

- ➢ Select (press) the *Power GMSK* softkey.

Additional Information...

... on Step 1

① **Analyzer/Generator menu**

The *Analyzer/Generator* menu contains three configuration panels intended to

- Set the CMU RF analyzer *(Analyzer Settings)*, i.e. determine the RF input signal that can be measured
- Control the RF generator *(Generator)* and define the parameters of the RF output signal generated
- Define the bit content of the generated signal *(Generator Modulation)*

The assignment between carrier frequency and channel number is according to GSM specifications. As the CMU simulates a mobile station, the generator signal corresponds to the uplink (signal direction from the mobile station towards the base station); the signal analyzed corresponds to the downlink (signal direction from the base station towards the mobile station). The channel/frequency assignment changes accordingly.

The RF frequency can be set in multiples of 200 kHz. With an additional *Frequency Offset*, an RF signal with an arbitrary frequency that is in the range supported by the tester can be generated and analyzed.

In general, the RF generator level is set to be different for the used timeslot and unused timeslots. The level of the unused timeslots is defined relative to the level in the used timeslot.

② **Measurement and Generator State**

The state indication of the *Power* and *Modulation* measurements and of the RF generator is included in the corresponding softkeys. For ongoing measurements, the results in the output fields are constantly updated. All measured quantities refer to the current burst.

For various reasons, an output field may fail to show a valid measurement result (indication "---"):

- The analyzer settings do not match the properties of the input signal.
- The input signal is missing.
- The measurement is switched off *(OFF* is indicated in the softkey controlling the measurement).

③ **Expected Power**

The *Expected Power* softkey is used to adjust the RF input path to the expected power of the measured signal. This is done automatically or by entering a definite maximum input power. The permissible range of *Expected Power* depends on the RF connector and the external attenuation used.

Alternative Settings and Measurements

☞ Chapter 4, p. 4.2 ff.

The three configuration panels are equivalent to the *Signal* tab of the *Connection Control* menu.

Selecting a definite training sequence (TSC) or bit modulation or transmission mode in the *Generator Modulation* panel implies that signals with these characteristics are generated.

Selecting a definite TSC in the *Analyzer Settings* panel implies that only signals with this TSC are analyzed.

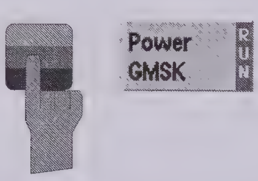
The current options for the measurement status are *ON* (default) and *OFF*. A third state, *HLT*, occurs after a single-shot measurement is terminated (see below).

Once selected, the *Power* or *Modulation* measurement can be switched off and on again by means of the toggle key *ON/OFF*.

Generators may also be switched on (state *ON)* and off (state *OFF)* by means of the *ON/OFF* key.

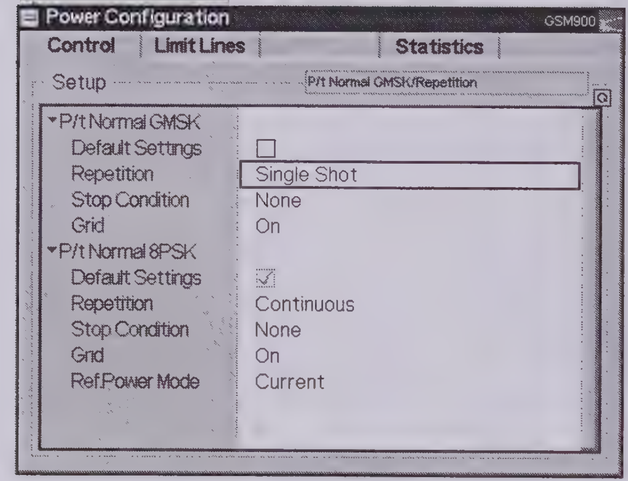
☞ Chapter 4, p. 4.60 ff.

The *Expected Power* can also be set in the *Group Config.* menu.


Power
GMSK
RUN

Step 2

- ➢ Press the selected *Power GMSK* softkey again to call up the *Power Configuration* menu.


Power Configuration
GSM900
Control
Limit Lines
Statistics

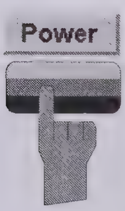
Setup P/t Normal GMSK/Repetition

▾P/t Normal GMSK	
Default Settings	☐
Repetition	Single Shot
Stop Condition	None
Grid	On
▾P/t Normal 8PSK	
Default Settings	☑
Repetition	Continuous
Stop Condition	None
Grid	On
Ref.Power Mode	Current

The *Power Configuration* menu defines the scope of the *Power* measurement. The settings offered in this menu are discussed in section *General Settings* in chapter 3. We pick just one example, limiting the number of bursts measured.①

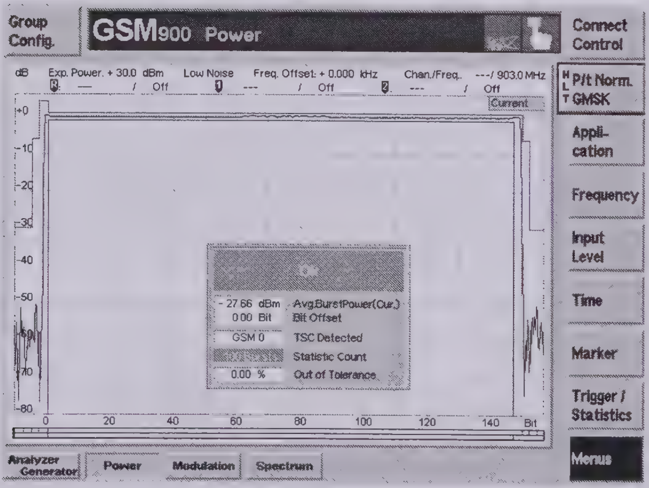
- ➢ Press the *ON/OFF* key or the rotary knob to expand the table.
- ➢ Select *Single Shot* in the *Repetition* line.②
- ➢ Press the *ESCAPE* key or the *Power* softkey again to close the *Power Configuration* menu and return to the main menu.

The Power measurement is stopped after one statistic count. The status indication next to the *Power GMSK* softkey is set to *HLT*.③



Step 3

- ➢ Press the *Power* hotkey to switch over to the graphical menu *Power*.


Group Config.
GSM900 Power
Connect Control
HLT P/t Norm. GMSK
Appli-cation
Frequency
Input Level
Time
Marker
Trigger / Statistics
Menus
Analyzer Generator
Power
Modulation
Spectrum
dB
+0
-10
-20
-30
-40
-50
-60
-70
-80
0
20
40
60
80
100
120
140
Bit
Current

Exp. Power. + 30.0 dBm Low Noise Freq. Offset: + 0.000 kHz Chan./Freq. ---/ 903.0 MHz
R: — / Off 1 --- / Off 2 --- / Off

- 27.66 dBm Avg.BurstPower(Cur.)
0.00 Bit Bit Offset
GSM 0 TSC Detected
Statistic Count
0.00 % Out of Tolerance

The *Power* menu shows the power of the current burst as a function of time. ④

(If no measuremnet curve is displayed, select the *P/t Norm. GMSK* softkey and press *CONT/HALT* to initiate another single shot *Power* measurement.)

Together with the burst power, a tolerance template as specified in the GSM standard is displayed. Settings (at present, the default settings) and scalar results are displayed in two parameter lines above the diagram and in a message box positioned in the center of the diagram.

Various tools allowing to take a closer look at the measurement results are provided in the graphical measurement menu.

Additional Information...

... on Step 2

① **Power Configuration menu**

The *Power Configuration* menu contains three tabs defining

- The repetition mode and stop condition *(Control)*
- The tolerance template for the burst *(Limit Lines)*
- The display mode and statistic count *(Statistics)* of the *Power* measurement

② **Repetition mode and Stop Condition**

If no stop condition is imposed *(Stop Condition = None)*, the *Repetition* mode determines whether the measurement is

- Continued until explicitly stopped by the operator *(Continuous)* or...
- Stopped after one statistic count *(Single Shot)*

By default, a statistic count comprises 100 bursts. With *Stop Condition = On Limit Failure*, the measurement is stopped after the first burst which is out of tolerance.

③ **Measurement in the HLT state**

In the *Analyzer/Generator* menu, the average and peak power of the last burst measured is indicated in the output fields *Average* and *Peak*.

In contrast, the modulation measurement is still running. The results for the frequency and phase errors are periodically updated.

... on Step 3

④ **Power menu**

The diagram in the *Power* menu shows a normal burst with a length of 148 bits (plus a guard period of 8.25 bits). The default tolerance template for the power ramp plotted with red lines is defined in the GSM specifications. The time scale of the diagram ranges from –10 bits to 156¾ bits covering the useful part, the rising and falling edges of the burst. The ordinate ranges from –80 dB to +10 dB, the 0-dB reference level is equal to the carrier power.

Note that settings made previously (*Power Configuration* menu) are preserved in the whole measurement group. Accordingly, the status of the measurement is still *HLT*. The diagram is fixed showing the last burst measured.

Alternative Settings and Measurements

☞ Chapter 3.

Settings made in the *Power Configuration* menu apply to power measurements only.

Settings made in *the Group Config.* and *Connect. Control* menus apply to the entire function group and mode *GSMxxx-BTS Non Signalling*.

☞ Chapter 3.

The *statistic count* is defined in the *Statistics* tab of the *Power Configuration* menu.

The stop condition *On Limit Failure* should be selected if the limit check represents the main purpose of the measurement.

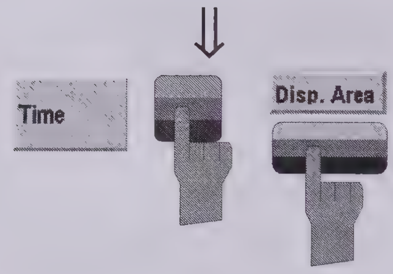
The limits can be modified in the *Limit Lines* tab of the *Power Configuration* menu.

☞ CMU manual

See the sections on measurement control in chapter 3 and 5.

☞ Chapter 4, p. 4.6 ff.

The GSM power template is generally defined relative to the carrier power. For low signal powers, a looser absolute limit is to be applied at the beginning and the end of the power ramp (areas 1, 2, 7, and 8). This yields the distorted template that we observe in the present example.


Time
Disp. Area

Step 4

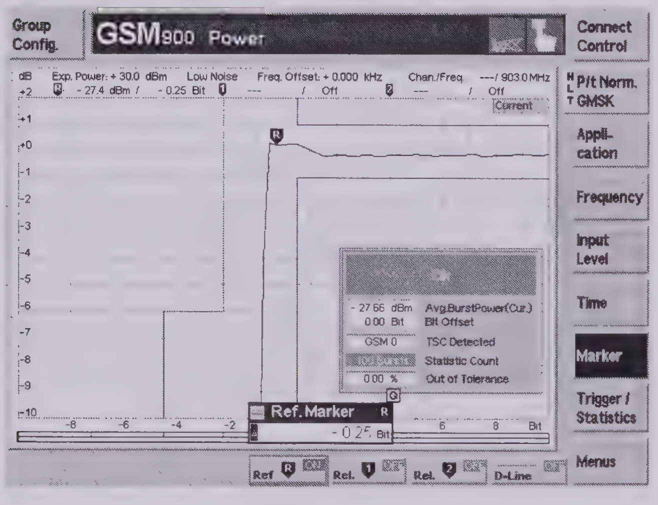
- ➢ Press the *Time* softkey to change the hotkeys displayed below the diagram.①
- ➢ Press the *Display Area* hotkey to open a window offering a list of different zoom areas.

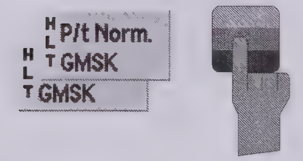
If you select *Left Upper Corner* the CMU zooms in on the left upper corner of the burst.

- ➢ Press the *Marker* softkey and the *Ref R* hotkey. Enter an abscissa value (in bits) to position a reference marker onto the trace.②

The coordinates (time and burst power) of the reference marker are displayed in the second parameter line.

For the next step we'll take advantage of the fact that the configuration menu is accessible from the graphical menu as well.

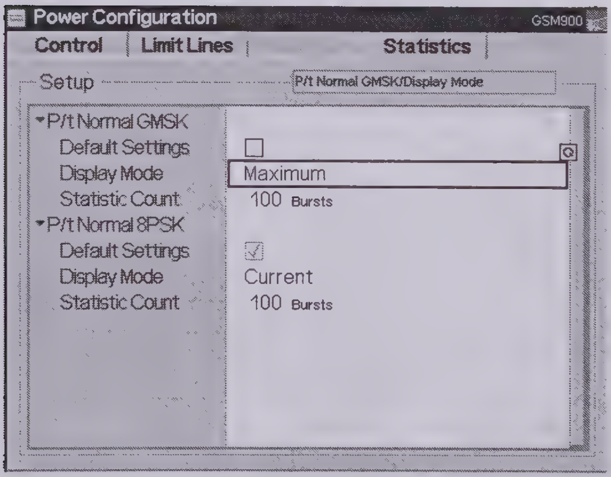

Group Config.
GSM900 Power
Connect Control
P/t Norm. GMSK
Appli-cation
Frequency
Input Level
Time
Marker
Trigger / Statistics
Menus
Exp. Power: + 30.0 dBm
Low Noise
Freq. Offset: + 0.000 kHz
Chan./Freq. ---/ 903.0 MHz
- 27.4 dBm / - 0.25 Bit
Current
- 27.66 dBm Avg.BurstPower(Cur.)
0.00 Bit Bit Offset
GSM 0 TSC Detected
Statistic Count
0.00 % Out of Tolerance
Ref. Marker
- 0.25 Bit
Ref
Rel.
Rel.
D-Line


P/t Norm. GMSK
GMSK

Step 5

- ➢ Press the *Power/t Norm. GMSK* softkey twice to reopen the *Power Configuration* menu.
- ➢ Select the Control tab.
- ➢ Select *Continuous* from the *Repetition* field to restart the measurement.
- ➢ Select the *Statistics* tab.
- ➢ From the *Display Mode* field, select *Maximum*.③
- ➢ Press *ESCAPE* or the *P/t Norm. GMSK* softkey again to close the configuration menu.

Instead of the current burst power, the diagram shows the maximum burst power measured at each time. As no stop condition is set, the measurement will be running until it is explicitly terminated.


Power Configuration
GSM900
Control
Limit Lines
Statistics
Setup
P/t Normal GMSK/Display Mode

P/t Normal GMSK
Default Settings ☐
Display Mode Maximum
Statistic Count 100 Bursts
P/t Normal 8PSK
Default Settings ☑
Display Mode Current
Statistic Count 100 Bursts

Additional Information...

Alternative Settings and Measurements

... on Step 4

① **Softkeys and hotkeys**

To enlarge the diagram area of the graphical measurement menus the left softkey column is suppressed. The functionality of each softkey on the right side is extended by hotkeys assigned to the softkeys. These hotkeys are displayed across the hotkey bar below the diagram when the softkey is selected.

Some of the softkey/hotkey combinations offer settings that are also accessible via configuration menus. For example, the *Input Level* settings are equivalent to the settings in the *Input Power* tab of the *Group Configuration* menu. Identical settings overwrite each other; the last value entered is valid for the whole function group and test mode.

☞ Chapter 4, p. 4.7 ff.

The *Application* softkey switches between the application of the *Power* measurement.

The *Frequency* softkey defines the frequency and channel of the measured signal.

The *Input Level* softkey controls the level in the RF input signal path.

The *Time* softkey configures the abscissa (time axis).

The *Trigger/Statistics* softkey sets the trigger condition and the display mode.

The *Marker* softkey sets markers and D-lines and determines the display area.

② **Markers**

Markers are graphical tools used to locate points on a trace and read out their coordinates. A reference marker and two delta markers may be defined in the *Power* menu.

The reference marker R measures the absolute level of the trace, the delta markers 1 and 2 measure the absolute level or (if set to relative) the distance between their position and the reference marker.

☞ Chapter 4, p. 4.7 ff.

In addition to markers, a D-line can be used to measure a particular level in the diagram.

... on Step 5

③ **Display mode**

If the measurement extends over several bursts the CMU calculates four different traces one of which can be selected in the *Display Mode* field. The purpose of the four traces is to give an overview of the range and arithmetic mean of the levels detected at any point on the time axis.

☞ Chapter 3.

To refine the statistical evaluation, a suitable combination of the statistic count, repetition mode, stop condition and display mode can be selected.

☞ Chapter 4, p. 4.15 ff.

Out-of-tolerance power measurements

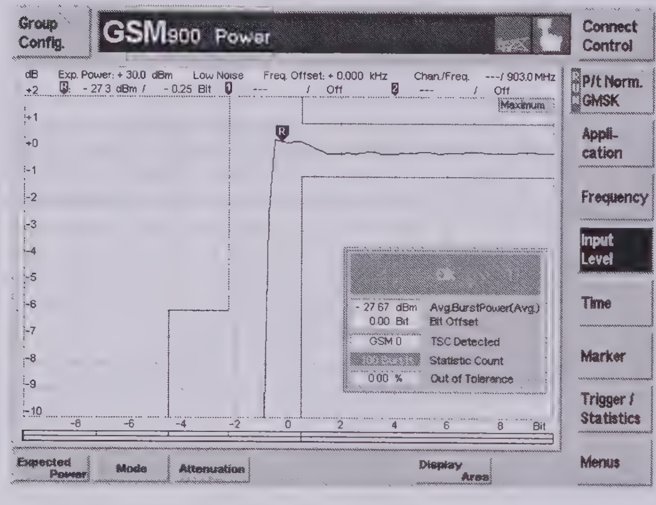
If a power measurement is out of tolerance, please ensure that the attenuation of any cables and/or antenna couplers used is being taken into account by the CMU. As many GSM power levels must be within ±2 dB of the nominal value given in the specifications, even a small attenuation can result in an out-of-tolerance measurement.

External attenuation values for each input/output may be entered in the *RF* ⊸ tab of the *Connect. Control* menu

The cables, RF connections and antenna couplers must also be in good condition for satisfactory measurements. Dirty or broken RF connections can cause problems at the high frequencies used by GSM networks.

Step 6

- ➢ Press the *ESCAPE* key to close the *Power Configuration* menu and return to the main menu.


Group Config.
GSM900 Power
Connect Control
P/t Norm. GMSK
Appli-cation
Frequency
Input Level
Time
Marker
Trigger / Statistics
Menus
Expected Power
Mode
Attenuation
Display Area
Maximum
dB
+2
+1
+0
-1
-2
-3
-4
-5
-6
-7
-8
-9
-10
-8
-6
-4
-2
0
2
4
6
8
Bit
R

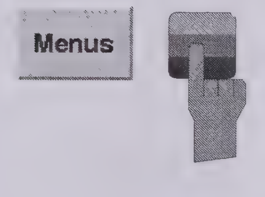
Exp. Power: + 30.0 dBm Low Noise Freq. Offset: + 0.000 kHz Chan./Freq. ---/ 903.0 MHz

R: - 27.3 dBm / - 0.25 Bit 1 --- / Off 2 --- / Off

- 27.67 dBm Avg.BurstPower(Avg.)
0.00 Bit Bit Offset
GSM 0 TSC Detected
Statistic Count
0.00 % Out of Tolerance

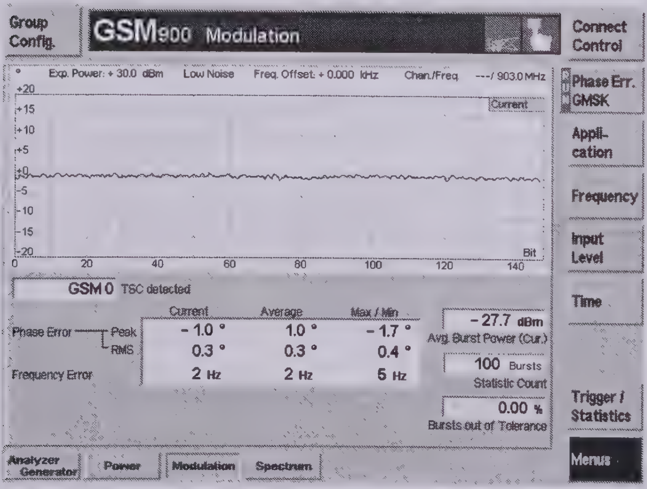
The trace is now continuously measured and updated in the display. With the display mode *Maximum,* which is indicated in the upper right corner of the diagram, trace values will be replaced only if a current measured value at a particular test point exceeds all values measured before at the same test point.

Step 7



Modulation

- ➢ Press the *Menus* softkey to display the measurement groups available in the hotkey bar.
- ➢ Press the *Modulation* hotkey to open the *Modulation* menu.


Group Config.
GSM900 Modulation
Connect Control
Phase Err. GMSK
Appli-cation
Frequency
Input Level
Time
Trigger / Statistics
Menus
Analyzer Generator
Power
Modulation
Spectrum
Current
°
+20
+15
+10
+5
+0
-5
-10
-15
-20
0
20
40
60
80
100
120
140
Bit

Exp. Power: + 30.0 dBm Low Noise Freq. Offset: + 0.000 kHz Chan./Freq. ---/ 903.0 MHz

GSM 0 TSC detected

		Current	Average	Max / Min
Phase Error	Peak	- 1.0 °	1.0 °	- 1.7 °
	RMS	0.3 °	0.3 °	0.4 °
Frequency Error		2 Hz	2 Hz	5 Hz

- 27.7 dBm Avg. Burst Power (Cur.)
100 Bursts Statistic Count
0.00 % Bursts out of Tolerance

The *Modulation* menu displays the results of the phase and frequency error measurement.①

The trace represents the phase error of the current burst as a function of time.②

Below, a table displays the extreme value of the phase error and the RMS phase error, and the frequency error. ③

The detected training sequence *(TSC)*, average power of the current burst and the statistic count are shown in addition.

Additional Information...

... on Step 7

① **Phase and frequency errors**

GSM specifies different modulation schemes; the basic scheme is GMSK modulation. The bits to be transmitted translate into the phase information of the RF signal. It is important that the modulation scheme is adhered to as strictly as possible. GSM specifies a peak phase error of max. 20°, a RMS-weighted phase error of max. 5° and a frequency error of max. 0.05 ppm of the transmit frequency.

The limits may be modified in the *Limits* tab of the *Modulation Configuration* menu, which is opened by pressing the selected *Ext. Phase Err. GMSK* softkey once again. The *Modulation Configuration* menu is analogous to the *Power Configuration* menu explained on the previous pages. According to the requirements of the measurements the two configuration menus differ in two points:

- Phase errors are relevant within the useful part of the burst. The specified limits are symmetric with respect to the 0 deg line and valid over the whole burst. It is not necessary to discriminate between different areas (see item ② below).
- The absolute value of the phase error is a measure of the quality of modulation, whereas the sign is of secondary interest. This is why the display modes *Minimum* and *Maximum* can not be selected separately, the CMU displays the extreme values instead (display mode *Minimum/Maximum*).

② **Measurement curve**

The diagram in the *Modulation* menu shows the useful part of a normal burst with a length of 148 bits, The time scale of the diagram, ranging from 0 bits to 146¾ bits, is thus shorter than in the *Power vs. Time* diagram. The ordinate is symmetric around 0 , ranging from –20 dB to +20 dB.

③ **Statistical quantities**

The table below the phase error diagram gives an overview of the phase error averaged over the current burst *(Phase Error RMS)*, the extreme value of the current phase error *(Phase Error Peak)*, the current frequency error, and the statistical distribution of these three quantities. The values in the three columns are calculated as follows:

- The *Current* column contains the frequency error, RMS-averaged phase error and peak (Max./Min.) phase error for the current burst.
- The *Average* column contains the three quantities averaged over the last statistics cycle.
- The *Maximum* column contains the extreme values of the three quantities within all bursts measured.

Alternative Settings and Measurements

☞ Chapter 4, p. 4.23 ff.

The measurement principle for phase and frequency errors is explained at the beginning of section *Measurement Menu (Modulation – GMSK).*

For configuration settings see section *Measurement Configurations (Modulation Configuration).*

As a second modulation scheme, the CMU supports 8PSK-modulated traffic channels (the so-called EDGE channels). For this measurement, option CMU-K41 is required.

☞ Chapter 4, p. 4.25 ff.

☞ Chapter 3.

This chapter gives a comprehensive description of measurement control and of the definition of statistical quantities.

☞ Chapter 4, p. 4.25 ff.

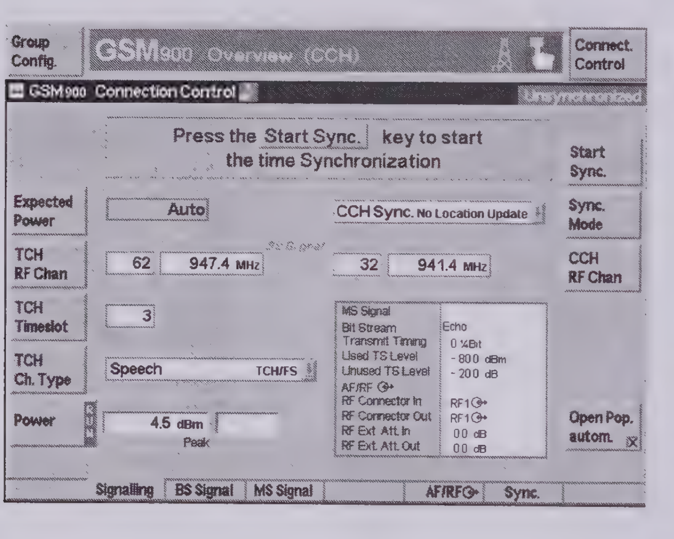
As a last measurement group in *Non Signalling* mode, the *Spectrum* measurement assesses the off-channel power due to the modulation and due to switching.

Signalling Mode

In the *Signalling* mode, the CMU receives a control channel signal from the base station to which it can synchronize. From the synchronized state (CCH Test), the CMU can initiate a location update and a call can be initiated from either the base station or the CMU (option CMU-K39 required). Measurements can be performed in the *Synchronized* state on both the CCH (control channel) and the TCH (traffic channel) and in the *Call Established* state (TCH). As an alternative to the BTS control channel, an external trigger signal can be used for synchronization.

Synchronization and Signalling Parameters

The signalling processes and configurations are controlled via the *Connection Control* popup menu. The first of several *Signalling* tabs contained in the *Connection Control* popup menu is automatically displayed when the *Signalling* test mode is selected (see *Menu Select* menu on page 2.4; for the following examples, *GSM900-MS Signalling Meas.* with the *Receiver Quality* menu was selected, and another *RESET* was performed).


Group Config.
GSM900 Overview (CCH)
Connect. Control
GSM900 Connection Control
Unsynchronized
Start Sync.
Sync. Mode
CCH RF Chan
Open Pop. autom.
Signalling
BS Signal
MS Signal
AF/RF
Sync.

Press the Start Sync. key to start the time Synchronization

Expected Power: Auto

CCH Sync. No Location Update

TCH RF Chan: 62 947.4 MHz

CCH RF Chan: 32 941.4 MHz

TCH Timeslot: 3

TCH Ch. Type: Speech TCH/FS

Power: 4.5 dBm Peak

MS Signal	
Bit Stream	Echo
Transmit Timing	0 ¼Bit
Used TS Level	- 80.0 dBm
Unused TS Level	- 20.0 dB
AF/RF	
RF Connector In	RF1
RF Connector Out	RF1
RF Ext. Att. In	0.0 dB
RF Ext. Att. Out	0.0 dB

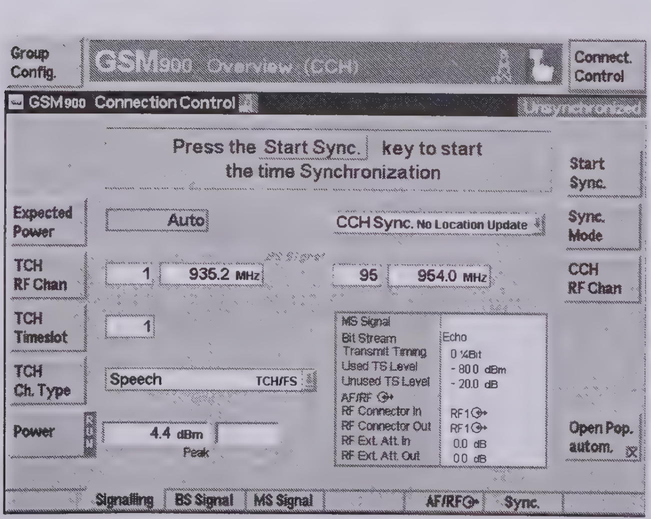
Step 1

The *Signalling (Unsynchronized)* tab configures the RF signals of the base station and initiates synchronization between the CMU and the base station.①

In addition it indicates the parameters of the TCH signal provided by the CMU and the RF connectors used. ②

Below the parameter list the *Power* softkey shows the current status of the wide-band peak power measurement, the current result *(Peak* output field*)* and its ratio to the maximum input power set in the *Group Configuration* menu (analog bar). ③

⇓


Group Config.
GSM900 Overview (CCH)
Connect. Control
GSM900 Connection Control
Unsynchronized
Start Sync.
Sync. Mode
CCH RF Chan
Open Pop. autom.
Signalling
BS Signal
MS Signal
AF/RF
Sync.

Press the Start Sync. key to start the time Synchronization

Expected Power: Auto

CCH Sync. No Location Update

TCH RF Chan: 1 935.2 MHz

CCH RF Chan: 95 954.0 MHz

TCH Timeslot: 1

TCH Ch. Type: Speech TCH/FS

Power: 4.4 dBm Peak

MS Signal	
Bit Stream	Echo
Transmit Timing	0 ¼Bit
Used TS Level	- 80.0 dBm
Unused TS Level	- 20.0 dB
AF/RF	
RF Connector In	RF1
RF Connector Out	RF1
RF Ext. Att. In	0.0 dB
RF Ext. Att. Out	0.0 dB

- ➢ Before starting synchronization, restore the test setup described in section *Preparing a GSM Base Station Test* on p. 2.2 ff. In particular, make sure that your base station is connected to RF 1 and that RF 1 is selected as RF input/output connector.
- ➢ Adjust the *CCH RF Chan* (control channel number of the BTS), the *TCH RF Chan* (traffic channel number of the BTS), the *TCH Timeslot*, and the *TCH Ch. Type* settings to the RF output signal of the base station under test.

Additional Information...

... on Step 1

① **Synchronization modes**

In *Signalling* measurements, the CMU is time-synchronized with the base station under test. The time reference can be provided in different ways:

- In the default mode *No Loc. Update CCH (fix)* the CMU uses the timing information transferred on the BTS control channel that is fed in via the current RF connector. After successful synchronization the CMU reaches the *CCH Test* state. The *TCH Test* state can be reached in a subsequent step.
- In the *Wired Sync. (Ext. Trigger)* mode the timing information is provided by an external TTL trigger signal with a TCH multiframe structure that is applied to pin no. 6 of the AUX 3 connector (multiframe trigger, see also description of the test setup on p. 2.2). After successful synchronization the CMU reaches the *TCH Test* state. The CCH from the BTS is idle so no *CCH Test* can be performed.

② **MS and BS Signals**

In the *Unsynchronized* state, both the RF signal generated by the CMU (MS Signal) and by the BTS (BS Signal) can be defined:

- The *MS Signal* tab configures the TCH signal transmitted from the CMU to the BTS under test, i.e. the data transmitted or retransmitted to the BTS, the timing and the levels in the used and unused timeslots. These parameters are indicated in the *MS Signal* table section of the *Signalling (Unsynchronized)* tab.
- The *BS Signal* tab configures the signal transmitted from the BTS under test to the CMU, i.e. the CCH and TCH channel number, the data transmitted to the CMU on the TCH, the used timeslot and the training sequence. All these parameters are also available for editing in the *Signalling (Unsynchronized)* tab.

③ **Wide-band power**

The *Power* softkey has no configuration menu assigned but can be used like any other softkey controlling a measurement. In particular, it is used to switch over between the measurement states *RUN* and *OFF* (softkey selection plus *ON/OFF* key) and *RUN/HLT* (softkey selection plus *CONT/HALT* key).

Alternative Settings and Measurements

☞ Chapter 4, p. 4.64 ff.

With option CMU-K39 *(MOC/MTC)*, it is possible to test the essential signalling issues and simulate the circumstances in a real GSM network. Starting from the *CCH Test* state, the CMU can initiate a location update and a call connection can be attempted from either the CMU (mobile originated call, MOC) or the base station (mobile terminated call, MTC). A large variety of network parameters are provided to configure the properties of the CMU acting as a mobile station.

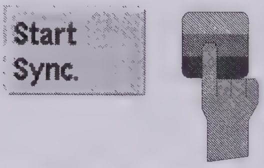
☞ Chapter 4, p. 4.64 ff.

See also description of the BS Signal tab on p. 4.103 and on the MS Signal tab on p. 4.104 ff.

All signal parameters except the CCH channel number can be set in the *TCH Test* and *CCH Test* states as well.

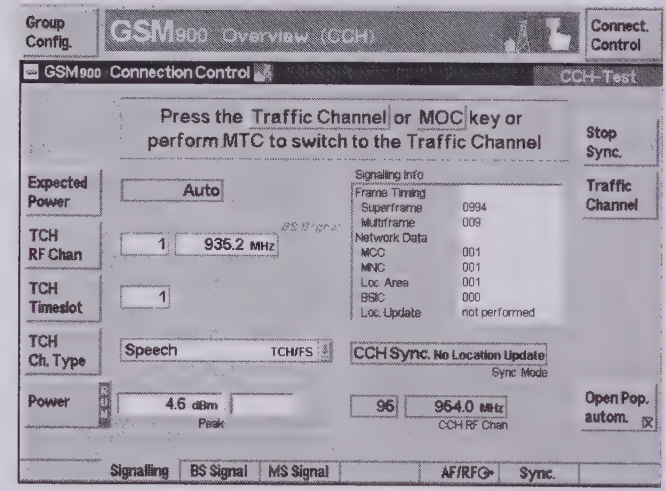
☞ Chapter 4, p. 4.66.

See also the diagrams on measurement control in chapter 5 of the CMU manual



Step 2

➢ Press the *Start Sync.* softkey.


Group Config.
GSM900 Overview (CCH)
Connect. Control
GSM900 Connection Control
CCH-Test
Stop Sync.
Traffic Channel
Expected Power
TCH RF Chan
TCH Timeslot
TCH Ch. Type
Power
Open Pop. autom.
Signalling
BS Signal
MS Signal
AF/RF
Sync.

Press the Traffic Channel or MOC key or perform MTC to switch to the Traffic Channel

Expected Power: Auto
TCH RF Chan: 1 935.2 MHz
TCH Timeslot: 1
TCH Ch. Type: Speech TCH/FS
Power: 4.6 dBm Peak

Signalling Info
Frame Timing
Superframe 0994
Multiframe 009
Network Data
MCC 001
MNC 001
Loc. Area 001
BSIC 000
Loc. Update not performed

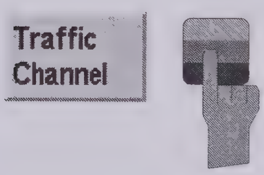
Sync Mode: CCH Sync. No Location Update
CCH RF Chan: 96 954.0 MHz

The *Signalling (Synchronizing)* tab with the header message *Searching for a control channel on RF channel...* is displayed. When the CMU has synchronized to the BS signal, the *Signalling (CCH Test)* tab is displayed. ④

The *Signalling (CCH Test)* still lets you change the parameters of the BS TCH signal. Besides, it indicates a list of signalling parameters *(Signalling Info)*.⑤

In the CCH states, all transmitter tests *(Power, Modulation, and Spectrum)* can be performed.

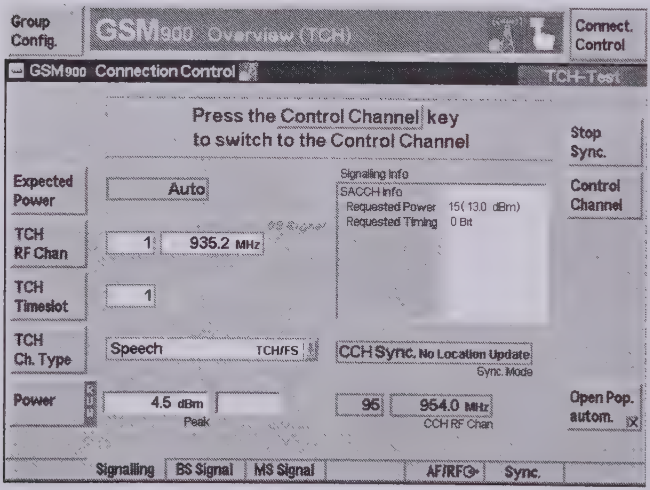
⇓


Traffic Channel

Step 3

➢ Press the *Traffic Channel* softkey.

⇓


Group Config.
GSM900 Overview (TCH)
Connect. Control
GSM900 Connection Control
TCH-Test
Stop Sync.
Control Channel
Expected Power
TCH RF Chan
TCH Timeslot
TCH Ch. Type
Power
Open Pop. autom.
Signalling
BS Signal
MS Signal
AF/RF
Sync.

Press the Control Channel key to switch to the Control Channel

Expected Power: Auto
TCH RF Chan: 1 935.2 MHz
TCH Timeslot: 1
TCH Ch. Type: Speech TCH/FS
Power: 4.5 dBm Peak

Signalling Info
SACCH Info
Requested Power 15(13.0 dBm)
Requested Timing 0 Bit

Sync. Mode: CCH Sync. No Location Update
CCH RF Chan: 95 954.0 MHz

The *Signalling (TCH Test)* still lets you change the parameters of the BS TCH signal. Besides, it indicates signalling parameters that are transferred by the base station over the SACCH associated to the allocated traffic channel *(Signalling Info)*.⑥

In the *TCH Test* state, all transmitter tests *(Power, Modulation, Spectrum)* and receiver tests *(Receiver Quality)* can be performed on the TCH from the base station.

➢ Press the *Escape* key to close the *Connection Control* menu and return to the *Receiver Quality* menu.

Additional Information...

Alternative Settings and Measurements

... on Step 2

④ **CCH test**

In the *CCH Test* mode, the CMU is able to perform all transmitter tests *(Power, Modulation, and Spectrum)* on the CCH from the base station. This implies that the measured timeslot is always timeslot 0; the traffic channel settings are irrelevant and therefore not provided in the individual measurement menus. *Receiver Quality* tests involving data transmission between the CMU and the BTS over the traffic channel are not possible in the *CCH Test* mode.

☞ Chapter 4, p. 4.69 ff.

The *Location Update* and *MOC* softkeys are only available with option CMU-K39, MOC/MTC.

⑤ **Signalling info**

The *Signalling Info* table contains signalling parameters that are transferred by the base station over the control channel:

- The *Frame Timing* section shows the CCH timing, expressed by the current values of the multiframe and superframe counters. A CCH multiframe consists of 51 TDMA frames; a superframe consists of 26 x 51 = 1326 TDMA frames. The multiframe counter wraps around after each complete superframe (26 multiframes), the superframe counter after 2^{12} superframes.
- The *Network Data* section shows the identity codes of the mobile station/CMU and of the BTS under test. Its 3-digit Mobile Country Code (MCC) and the 2-digit Mobile Network Code (MNC) identify the CMU. The 3-digit Location Area Code and the 6-bit BTS Identity Code (BSIC) identify the BTS.

☞ Chapter 4, p. 4.69 ff.

... on Step 3

⑥ **TCH test**

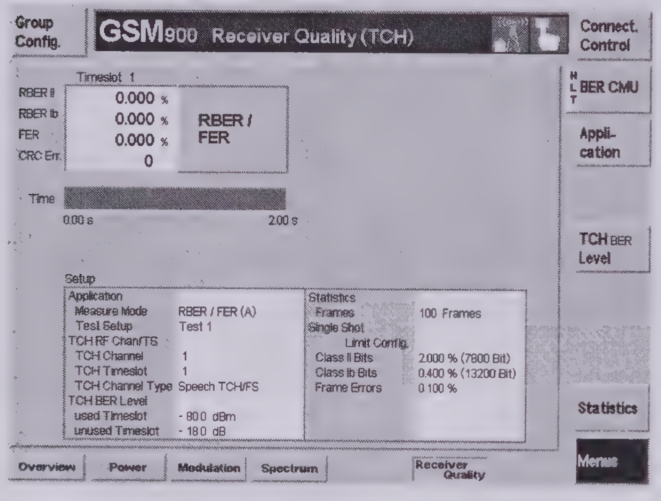
In the *TCH Test* mode, the CMU is able to perform all transmitter tests *(Power, Modulation, and Spectrum)* on the TCH from the base station. *Receiver Quality* tests involving data transmission between the CMU and the BTS over the traffic channel must be performed in the *TCH Test* mode.

☞ Chapter 4, p. 4.71 ff.

Receiver Quality Measurements

Receiver Quality measurements evaluate parameters which characterize the quality of transmission on the complete transmission path between CMU and base station. To this purpose the bits sent to the base station are looped back and retransmitted. The CMU compares the bits received with those sent and can thus calculate the percentage of faulty bits.

Note: *To perform a* Receiver Quality *measurement, the BTS under test must be set to a special test mode where the received data is retransmitted to the CMU (closed loop).*


Group Config.
GSM900 Receiver Quality (TCH)
Connect. Control
BER CMU
Appli-cation
TCH BER Level
Statistics
Menus
RBER / FER
Overview
Power
Modulation
Spectrum
Receiver Quality

Timeslot 1
RBER II 0.000 %
RBER Ib 0.000 %
FER 0.000 %
CRC Err. 0

Time 0.00 s 2.00 s

Setup
Application
Measure Mode RBER / FER (A)
Test Setup Test 1
TCH RF Chan/TS
TCH Channel 1
TCH Timeslot 1
TCH Channel Type Speech TCH/FS
TCH BER Level
used Timeslot - 80.0 dBm
unused Timeslot - 18.0 dB

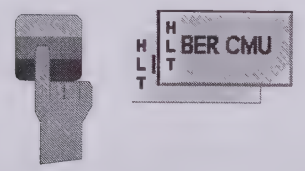
Statistics
Frames 100 Frames
Single Shot
Limit Config.
Class II Bits 2.000 % (7800 Bit)
Class Ib Bits 0.400 % (13200 Bit)
Frame Errors 0.100 %

Step 1

The *Receiver Quality* menu controls the receiver quality tests and displays the measurement results together with an overview of the test settings *(Setup* table).

- ➢ Press the *Application* softkey to display all applications of the *Receiver Quality* measurement group. ①
- ➢ Press the *Meas. Mode* hotkey and select *Burst by Burst.* ②

⇓

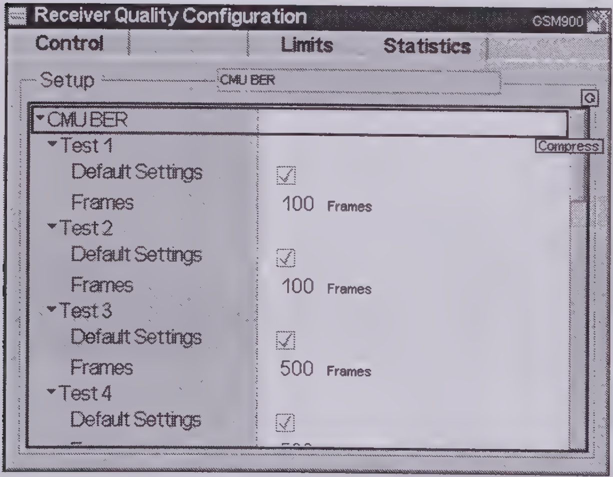

HLT
HLT
BER CMU

Step 2

- ➢ Press the *BER CMU* softkey twice.

The *Receiver Quality Configuration* menu is opened.

⇓


Receiver Quality Configuration
GSM900
Control
Limits
Statistics
Compress

Setup CMU BER
CMU BER
Test 1
Default Settings ☑
Frames 100 Frames
Test 2
Default Settings ☑
Frames 100 Frames
Test 3
Default Settings ☑
Frames 500 Frames
Test 4
Default Settings ☑

Most parameters of the *Receiver Quality Configuration* menu are equal or analogous to the ones used in *Power* or *Modulation* measurements. Major differences occur in the measurement modes available (*Control* tab, ②) and in the definition of the measurement statistics *(Statistics* tab, ③).

Additional Information...

Alternative Settings and Measurements

... on Step 1

① **Applications**

Within the *Receiver Quality* measurement group, the measurements *BER CMU* (single shot bit error rate tests) and *BER CMU Average* (continuous bit error rate tests) are treated as different applications. Applications are different measurements belonging to the same measurement group. Each application is assigned its own set of configuration parameters. Therefore, the applications within a measurement group can be configured individually and serviced in parallel.

Single shot measurements (application *BER CMU)* are further split up into different test setups. Up to ten different test setups with independent parameters can be configured.

☞ Chapter 4, p. 4.87 ff.

For a general discussion of measurement control and applications see chapters 3 and 5 of the CMU manual.

For test setups see the *Test Setup* hotkey and the different tabs in the *Receiver Quality Configuration* menu).

② **Measurement Mode**

A number of different quantities characterizing the quality of transmission are defined:

- Bit error rate (for class II and class Ib bits)
- Residual bit error rate (for class II and class Ib bits)
- Frame erasure rate

The type of quantities measured depends on the measurement mode *(BER, RBER/FER*, or *Burst by Burst).* In the *Burst by Burst* mode, which is specified for GSM phase II and phase II+ base stations, only bits without error protection are transmitted and the data loop in the base station is closed before the channel decoder and coder. This enhances the speed of the bit error rate test (fast BER test).

☞ Chapter 4, p. 4.91 ff.

The bit classes and measured quantities are explained at the beginning of section *Measurement Menu Receiver Quality*.

... on Step 2

③ **Statistics**

In the framework of sensitivity tests the basic evaluation period is equal to the frames used by the speech coder and consisting of 260 bits. Bursts and TDMA frames are irrelevant.

A statistics cycle thus consists of a definite number of frames.

☞ Chapter 3 and 4.

Failed Receiver Quality Test

If a BER test fails check the following:

1. Ensure that the attenuation of any antenna coupler and/or cables used is being taken into account by the CMU. During the test the base station receiver is being tested with very low RF signal levels, and even a small attenuation can cause the CMU to show a fail indication.
2. An external signal from a real network may interfere with the signal sent from the CMU to the base station, in particular during BER tests where the output level of the CMU is reduced to as low as -104 dBm. The BER test should ideally be performed in a shielded room, however, if this is not possible, the channel(s) used for the test should be changed. If different results are obtained on neighboring channels, the problem is likely to be due to external interferences.

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Test Modes 3.1

Configurations 3.3

Measurement Groups 3.4

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3 Manual Control

This chapter gives a brief survey of the operating concept and the structure of the user interface for GSM base station tests. The CMU was designed for maximum operating convenience and flexibility. All instrument functions are grouped together in menus, each of them provides a number of related configuration settings or displays a group of measured quantities. All menus show a similar structure so that many settings, once defined, can be used in several measurements. Switchover between the different menu groups and test modes *(Signalling – Non Signalling)* is possible at any time.

In the following, the different measurement modes and measured quantities are discussed. Settings and measurement parameters frequently encountered are explained from a general point of view.

The formal aspects of measurement control are discussed in more detail in chapter 5 *(Remote Control – Basics)*. For a presentation of the CMU's control elements, menu types and dialog elements within the menus refer to chapter 3 of the operating manual for the CMU basic unit.

Menu Structure

The menus used to control GSM measurements can be arranged in different ways. From the functional point of view, they form the following groups:

- The function groups *GSM400-BTS, GSM900-BTS, GSM1800-BTS* and *GSM1900-BTS*,
- The two test modes *Signalling* and *Non Signalling*
- General configurations *(Group Configuration, Connection Control)*, configurations specific to a measured quantity *(Power Configuration, Modulation Configuration, Spectrum Configuration, Receiver Quality Configuration)*, and menus displaying the results of the measurement *(Analyzer/Generator, Overview, Power (P/Time, P/Slot), Modulation (Phase Error GMSK, Overview 8PSK, EVM 8PSK, Phase Error 8PSK, Magnitude Error 8PSK), Spectrum (due to Modulation* and *due to Switching), Receiver Quality)*.

In a more formal sense, the CMU uses main menus, popup menus, graphical measurement menus and dialog windows of various size. This aspect is discussed in chapter 3 of the operating manual for the CMU basic unit.

Test Modes

GSM measurements are performed in one of the two modes *Signalling* or *Non Signalling*. The *Non Signalling* mode is typically used for module tests or test of base stations in a special "test mode". The *Signalling* mode serves to measure the base station performance under realistic operating conditions where the CMU mimics a GSM mobile station.

Definition	The term signalling denotes all actions necessary to establish, control and terminate a communication between the base station and the mobile phone. The signalling messages conveyed allow the mobile station and the network to discuss the management of issues either related to the user or concerning technical aspects of the communication.
Non Signalling Mode	In the *Non Signalling* mode, the CMU generates an RF signal conforming to GSM specifications and analyzes the signal with GSM characteristics (i.e. with definite level in the designated channel and in the adjacent channels, definite phase and frequency, and bit content) retransmitted by the device under test. No signalling parameters are transferred so that test times can be reduced consid-

erably. The test signal may be inside or outside the designated GSM channel range.

Normal burst signals are generated and analyzed. Various transmitter quality measurements (burst power versus time, average burst power, phase and frequency errors, error vector magnitude, I/Q imbalance and origin offset in the constellation diagram, adjacent channel power due to switching and due to modulation) can be performed. GMSK and 8PSK-modulated signals are supported. The measurement may be triggered by an additional external signal.

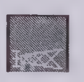
Signalling Mode

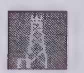
In the *Signalling* mode, the CMU receives a control channel signal from the base station to which it can synchronize. From the synchronized state (CCH Test), the CMU can initiate a location update and a call can be initiated from either the base station or the CMU (option CMU-K39 required). Measurements can be performed in the *Synchronized* state on both the CCH (control channel) and the TCH (traffic channel) and in the *Call Established* state (TCH).

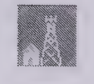
The CMU is able to configure a broad range of network parameters and to determine the parameters characterizing the base station. Measurements of the burst power versus time, the average burst power in subsequent timeslots, the modulation parameters (phase and frequency errors, I/Q imbalance and origin offset in the constellation diagram), the adjacent channel power due to switching and due to modulation, and of the bit error rate can be performed for normal bursts. GMSK and 8PSK-modulated signals are supported.

Symbols for Signalling Mode and State

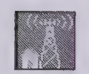
The *signalling mode* and *state* is indicated to the left of the operating mode in each main menu and graphical measurement menu (see chapter 3 of CMU operating manual). The following symbols occur in function group *GSM900/1800/1900-BTS:*

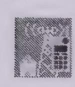

Non signalling mode


Signalling mode, Unsynchronized


Signalling mode, Synchronizing

Signalling mode, CCH Test


Signalling mode, TCH Test


Signalling mode, Location Update in Progress / Call in Progress / Call Established / Call Release in Progress

Configurations

The CMU offers a wide range of settings for signal generators and analyzers, the signalling procedures, and the individual measurements. Configurations can be set either for the whole function group *(Group Configuration, Connection Control)* or for a particular measurement.

Group Configuration

The *Group Config.* softkey is located on the left side of the title bar of each main and graphical measurement menu. It opens a popup menu with several tabs configuring

- The CMU receiver settings *(Input Power)*
- The trigger mode *(Trigger)*

All settings made in the *Group Config.* menu are valid for the whole function group. Most of them can be overwritten, however, by means of the softkeys and hotkeys offered in the graphical measurement menus.

Connection Control

The *Connect. Control* softkey is located on the right side of the title bar of each main and graphical measurement menu. It opens a popup menu with several tabs controlling

- The signal generators and analyzers of the instrument *(Signal* in Non Signalling, *MS Signal* and *BS Signal* in Signalling mode)
- The RF connectors to be used and the external attenuation *(RF Input/Output)*
- The reference signal and the system clock *(Synch.)*
- In *Signalling* mode, all actions changing the CMU's signalling state *(Signalling)*
- In *Signalling* mode, parameters of the network and the mobile station under test *(Network)*

All settings made in the *Connect. Control* menu apply to the whole function group.

Configurations of measurements

A popup menu offering specific settings is assigned to each measurement group *(Power vs. Time, Modulation and Receiver Quality).* The following parameters can be defined:

- The repetition mode and stop condition for the measurement *(Control)*
- Tolerances for the measured quantities *(Limits, Limit Lines)*
- Statistic count and display mode *(Statistics)*

These settings are explained in more detail below (see section *General Settings* on page 3.5).

Configuration via hotkeys

The softkeys and associated hotkeys in the graphical measurement menus provide the most important configurations for the current measurement; see chapter 4 and chapter 3 of the CMU operating manual. Settings may via hotkeys supersede the corresponding *Group Configuration* settings.

Measurement Groups

Measurement results are indicated in two different ways:

- Discrete values and parameters are displayed in output fields, lists and tables. In remote control, these results are referred to as scalars.
- Traces are displayed in a Cartesian coordinate system, the time forming the x-axis scale. Relatively small sets of test points are generally viewed in a bar graph. In remote control, results of this type are referred to as arrays.

While the measurement is running in repetition mode *continuous* (see page 3.5), the indicated results are constantly updated. As shown in the table below, the measurement groups are different for the two test modes.

Table 3-1 Measurement Groups in the *Signalling* and *Non Signalling* Mode

Non Signalling	**Signalling**
Analyzer/Generator Shows the settings for the signals generated and analyzed by the instrument and presents an overview of the basic scalar power and modulation results.	**Overview** Shows and sets the parameters of the TCH signals from the base station and presents an overview of the basic scalar power and modulation results. Various signalling parameters are indicated in addition.
Power Application *P/t Norm. GMSK/8PSK:* Diagram showing the trace of the measured burst power as a function of time. The peak power, statistical results and the results of the limit check are indicated in addition. Single points of the trace may be evaluated using graphical tools (markers, D-Line).	**Power** Application *P/t Norm. GMSK/8PSK:* Diagram showing the trace of the measured burst power as a function of time. The peak power, statistical results and the results of the limit check are indicated in addition. Single points of the trace may be evaluated using graphical tools (markers, D-Line). Application *P/Slot:* Bar graph showing the average burst power in 8 consecutive timeslots.
Modulation Application *Phase Err. GMSK:* Diagram showing the phase error within the burst as a function of time. The frequency error, average and RMS phase error, statistical results and the results of the limit check are indicated in addition. Application *Overview 8PSK:* Table showing a statistical evaluation of 8PSK modulation parameters. Application *EVM 8PSK:* Diagram showing the error vector magnitude (EVM) within the burst as a function of time plus a statistical evaluation of 8PSK modulation parameters. Application *Magn. Error 8PSK:* Diagram showing the magnitude error within the burst as a function of time plus a statistical evaluation of 8PSK modulation parameters. Application *Phase Error 8PSK:* Diagram showing the phase error within the burst as a function of time plus a statistical evaluation of 8PSK modulation parameters.	**Modulation** Application *Phase Err. GMSK:* Diagram showing the phase error within the burst as a function of time. The frequency error, average and RMS phase error, statistical results and the results of the limit check are indicated in addition. Application *Overview 8PSK:* Table showing a statistical evaluation of 8PSK modulation parameters. Application *EVM 8PSK:* Diagram showing the error vector magnitude (EVM) within the burst as a function of time plus a statistical evaluation of 8PSK modulation parameters. Application *Magn. Error 8PSK:* Diagram showing the magnitude error within the burst as a function of time plus a statistical evaluation of 8PSK modulation parameters. Application *Phase Error 8PSK:* Diagram showing the phase error within the burst as a function of time plus a statistical evaluation of 8PSK modulation parameters.

Non Signalling	**Signalling**
Spectrum Shows the amount of energy that spills outside the designated channel. The off-channel spectrum is caused by the modulation (spectrum due to modulation) and to the bursty nature of the RF signal (spectrum due to switching). Statistical results and the results of the limit check are indicated in addition.	**Spectrum** Shows the amount of energy that spills outside the designated channel. The off-channel spectrum is caused by the modulation (spectrum due to modulation) and to the bursty nature of the RF signal (spectrum due to switching). Statistical results and the results of the limit check are indicated in addition.
–	**Receiver Quality** Shows the results of the bit error rate test and the residual bit error rate test. In the *BER CMU Search* application, a BTS receiver input level corresponding to a given bit error rate (sensitivity level) is determined.

A graphical overview of the menus is given at the end of this chapter.

General Settings

A number of settings can be made in several of the configuration menus assigned to the measurement groups *Power vs. Time*, *Modulation, Spectrum,* and *Receiver Quality*. In combination, these settings define the scope of the measurement, i.e. the number of bursts measured and the results displayed. The following brief overview is intended to avoid confusion of terms.

Application

Applications represent different measurements belonging to the same measurement group. They effectively split up a measurement group into various related subgroups which can be configured separately.

They are selected via the *Application* softkey in the graphical measurement menus.

Statistic Count

The statistic count is equal to the integer number of evaluation periods which form one measurement cycle. An evaluation period corresponds to the duration of a burst (measurement groups *Power vs. Time*, *Modulation, and Spectrum)* or a speech frame (measurement group *Receiver Quality)*. Together with the *stop condition,* the *repetition mode* determines when exactly the measurement is stopped.

The *statistic count* is set in the *Statistics* tab of the configuration popup menus assigned to each measurement group.

Repetition Mode

The *repetition mode* defines how many statistics cycles are measured if the measurement is not stopped by a limit failure (see stop condition *On Limit Failure* below). Two modes are available for all measurements:

Single Shot	The measurement is stopped after one statistics cycle
Continuous	The measurement is continued until explicitly terminated by the user

A third repetition mode is available with remote control:

Counting	Repeated single shot measurement with a fixed number of statistic counts

The *repetition mode* is set in the *Control* tab of the configuration popup-menus assigned to the three measurement groups *Power vs. Time*, *Modulation,* and

Spectrum. In the *Receiver Quality* menu, the repetition mode can be set via the *Application* softkey.

Stop Condition

For *Power vs. Time, Modulation, and Spectrum* measurements, two stop conditions can be selected:

None	The measurement is performed according to its repetition mode, regardless of the measurement results,
On Limit Failure	The measurement is stopped as soon as one of the limits is exceeded, regardless of the repetition mode set. If no limit failure occurs, it is performed according to its repetition mode.

For *Receiver Quality* measurements, the stop condition *None* (see above) and two further conditions can be selected:

1st Limit exceed.	The measurement is stopped as soon as one of the limits is exceeded
All Limits exceed.	The measurement is stopped as soon as all limits defined are exceeded. Again, if no limit failure occurs, it is performed according to its repetition mode.

The *stop condition* is set in the *Control* tab of the configuration popup-menus assigned to the each measurement group.

Display Mode

In graphical measurement diagrams, the *display mode* defines which of the measured and calculated traces is displayed if the measurement extends over several bursts. In general, traces are evaluated at a set of fixed, equidistant test points (samples). After n bursts, n measurement results per test point have been taken. After a single shot measurement extending over c bursts, c measurement results per test point have been taken.

Current	The current burst, i.e. the last result for all test points, is displayed.
Minimum	At each test point, the minimum value of all bursts measured is displayed.
Maximum	At each test point, the maximum value of all bursts measured is displayed.
Max./Min.	At each test point, the extreme value of all bursts measured is displayed, i.e. the maximum or minimum, whichever has a larger absolute value.
Average	At each test point, a suitably defined average over all bursts measured is displayed; see paragraph entitled *Calculation of average quantities* below.

Note the difference in the calculation of *Average* on one hand, *Minimum, Maximum* and *Max./Min.* on the other hand, if the measurement extends over more than one statistic count (repetition mode *Continuous,* measurement time longer than one statistic count).

After evaluation of the different traces, the burst power is logarithmized and plotted in a semi-logarithmic diagram.

The *display mode* is set in the *Control* tab of the configuration popup-menus assigned to the measurement groups *Power, Modulation,* and *Spectrum.*

Calculation of average quantities

The *Average* traces in the *Power, Modulation,* and *Spectrum* menus are obtained as follows:

Let c be the number of bursts forming one statistics cycle (one *statistic count)* and assume that n bursts have been measured since the start of the measurement. In calculating the *Average* trace, the following two situations are distinguished:

n ≤ c Single shot measurement or continuous measurement during the first statistics cycle: At each test point, *Average* trace no. n is calculated from *Average* trace no. n – 1 and *Current* trace no. n according to the following recurrence:

$$Avg(n) = \frac{n-1}{n} Avg(n-1) + \frac{1}{n} Curr(n) \qquad (n = 1,\ldots,c)$$

The *Average* trace represents the arithmetic mean value over all n bursts measured.

n > c Continuous measurement after the first statistics cycle: At each test point, *Average* trace no. n is calculated from *Average* trace no. n – 1 and *Current* trace no. n according to:

$$Avg(n) = \frac{c-1}{c} Avg(n-1) + \frac{1}{c} Curr(n) \qquad (n > c)$$

Scalar quantities are averaged in analogy to *Average* traces.

Calculation of statistical quantities

In *Power* and *Modulation* measurements the statistical functions *Average, Minimum, Maximum* and *Minimum/Maximum* are applied to a set of test points depending on two independent parameters:

- The time, i.e. the abscissa values t_i, i ranging from 1 to the total number of test points comprising the trace.
- The burst number ranging from 1 to the number n of the current burst.

The result of the statistical operations depends on the parameter range considered and – in the case of statistics functions evaluated over several parameters – on the order of evaluations. This is why the definition of statistical quantities deserves some attention and is explained in the relevant sections in chapter 4. Some particular examples are:

1. In the *Power* menu, the quantity *Average Burst Power* denotes the average power of the current burst. i.e. the arithmetical mean value of all test points t_i located in the useful part of the burst (lower area 1 in the power template in chapter 4).
2. In the *Modulation* menu quantities such as the *Frequency Error*, *Phase Error RMS, Phase Error Peak* etc. are first calculated for the current burst and entered in the *Current* column of the output table. The results in the *Minimum/Maximum* column correspond to the extreme value of the *Current* results calculated over all bursts measured. The results in the *Average* column correspond to the average of the *Current* results calculated according to the prescription in paragraph *Calculation of average quantities* above.

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4 Functions and their Application

This chapter explains in detail all functions for the measurement of base stations supporting the GSM standard.

The chapter is divided in two sections corresponding to the two function groups for module tests *(GSM400/900/1800/1900-BTS Non Signalling)* and for tests including signalling *(GSM400/900/1800/1900-BTS Signalling)*. Within the two sections, the discussion is structured according to the provided measurements and configurations (see graphical overview at the end of chapter 3). In contrast to chapter 6, *Remote Control – Commands,* general measurement configurations are relegated to the end of each section.

The description of each softkey, select or input field is followed by the corresponding remote-control commands. Similarly, the description of the commands in chapter 6 also contains the corresponding menus of the user interface.

Each menu and each panel is briefly described first and then illustrated together with its call button. The menu functions are explained according to the following scheme:

Softkey	Short function definition
Designation of select/input field	Definition of field function. Further description of the field: purpose, interaction with other settings, notes... *Parameter 1* Description of parameter 1 *Parameter 2* Description of parameter 2 ... Further description of the parameters: purpose, interaction with other settings, notes...
Remote control	`Remote-control command (long form) Parameter1	Parameter2` `...`

For all numerical values, including their ranges and default settings, please refer to the description of the remote-control commands in chapter 6.

The description of the operating concept is to be found in chapter 3 of the operating manual for the CMU basic instrument; besides, a description of measurement control and the essential settings and a graphical overview of the most important menus is given at the end of chapter 3 in the present GSM manual. A comprehensive index listing important keywords and the proper names of all menus, dialog elements and softkeys is appended to the end of this manual.

GSM Module Tests (Non Signalling)

The structure of this section is based on the configuration and measurement groups defined in the function group *GSM400/900/1800/1900-BTS Non Signalling*, i.e. the menus of the graphical user interface. The menus will be dealt with in their order of operation:

1. Global settings *(Analyzer/Generator)* and display of generator signals
2. Measurement menus *(Power, Modulation* and *Spectrum)*: performance of the measurements, output of measurement results, specific measurement configurations
3. Global configurations *(Group Configuration, Connection Control)*

Analyzer/Generator Settings

The main menu *Analyzer/Generator* configures the transmitter and receiver side, i.e. the signals of the RF generator and the signals received and analyzed by the CMU. At the same time, it displays the current values of important power and modulation parameters of the received signal.

With respect to layout and function, the three panels for signal configuration are identical with the panels that constitute the *Signal* tab in the popup menu *Connection Control:*

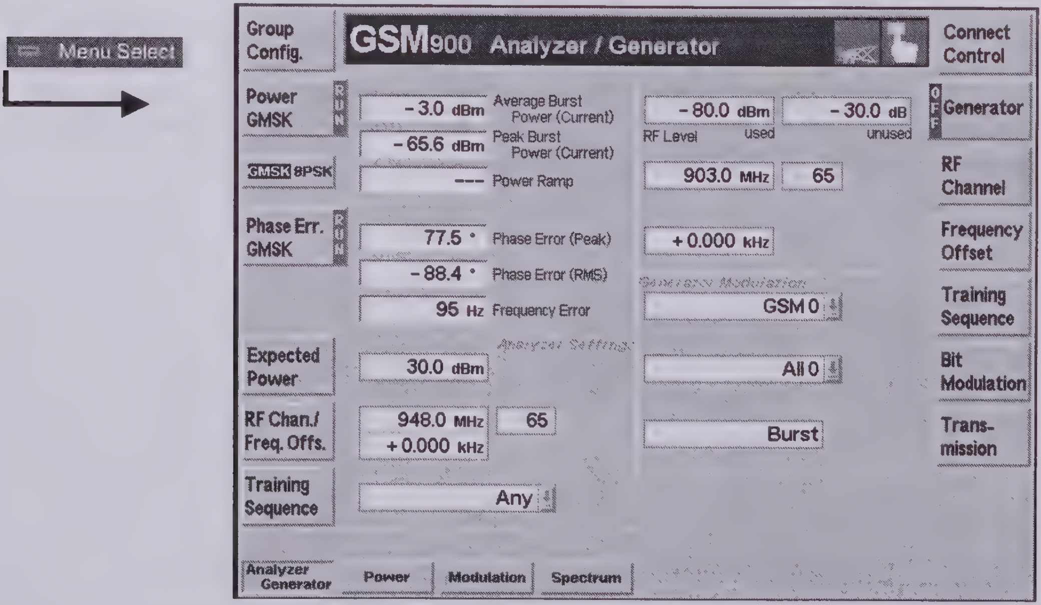
Panel Analyzer Settings	Analyzer control	See page 4.50
RF Generator Panel	Generator control	See page 4.53
Generator Modulation	Generator modulation	See page 4.55

Two further panels indicate characteristic parameters of the signal received by the CMU (average values, extreme values, matching of tolerances):

Panel Power	Results of power measurement
Panel Modulation	Results of modulation measurement (phase and frequency errors)

The behavior of these parameters as a function of time can be displayed in the measurement groups *Power* and *Modulation*.

The main menu *Analyzer/Generator* is opened via the main menu *Menu Select* (with associated key at the front of instrument). It is connected with the remaining measurement menus of the function group *GSM400/900/1800/1900-BTS Non Signalling Mode* via the hotkeys.

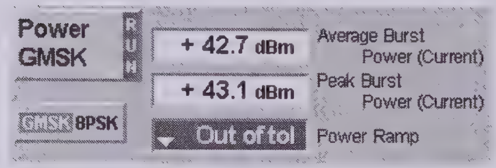


-3.0 dBm Average Burst Power (Current)
-65.6 dBm Peak Burst Power (Current)
--- Power Ramp
77.5 ° Phase Error (Peak)
-88.4 ° Phase Error (RMS)
95 Hz Frequency Error
Analyzer Settings
Expected Power 30.0 dBm
RF Chan./Freq. Offs. 948.0 MHz 65 +0.000 kHz
Training Sequence Any
RF Level -80.0 dBm used -30.0 dB unused
903.0 MHz 65
+0.000 kHz
Generator Modulation
GSM 0
All 0
Burst

Fig. 4-1 Measurement menu Analyzer / Generator

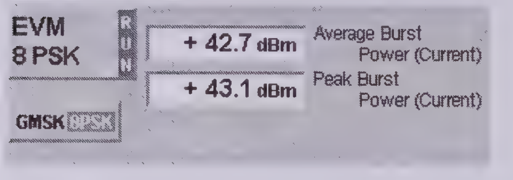
Power Panel

The *Power* panel depends on the modulation scheme selected:



Power GMSK
RUN
GMSK 8PSK
+ 42.7 dBm Average Burst Power (Current)
+ 43.1 dBm Peak Burst Power (Current)
Out of tol Power Ramp

With GMSK modulation, the panel contains three output fields indicating the average and the peak power as well as the tolerance matching of the current burst. These results are also indicated in the info box in the graphical measurement menu *Power* (page 4.6 ff).



EVM 8 PSK
RUN
GMSK 8PSK
+ 42.7 dBm Average Burst Power (Current)
+ 43.1 dBm Peak Burst Power (Current)

With 8PSK modulation (option CMU-K41 required), the output fields indicating the average and the peak power are part of the *EVM 8PSK* panel; see p. 4.5). The power ramp matching is not indicated.

Power GMSK

The *Power GMSK* softkey controls the power measurement and indicates its status *(RUN | HLT | OFF)*.

This status can be changed after softkey selection (pressing once) by means of the *ON/OFF* key or the *CONT/HALT* key. The status of the measurement is unaffected upon switchover to other menus controlling a *Power* measurement, however, a running measurement is restarted.

The *Power GMSK* softkey is not available with 8PSK modulation.

Measurement configuration

Pressing the *Power GMSK* softkey twice opens the popup menu *Power Configuration* (see page 4.15).

Remote control

```
INITiate:POWer:NBURst:GMSK
ABORt:POWer:NBURst:GMSK
STOP:POWer:NBURst:GMSK
CONTINUE:POWer:NBURst:GMSK
```

Average

Average power of the current burst in dBm. As no average is taken over several bursts the result does not depend on the repetition mode; it is equal for single shot and for continuous measurements.

Peak

Peak power of the current burst in dBm. As no comparison is made between different bursts the result does not depend on the repetition mode (single shot or continuous measurement).

Power Ramp

Matching of the tolerances by the current burst. The messages that may appear in the list field are self-explanatory.

Remote control

```
READ[:SCALar]:POWer:NBURst:GMSK?
FETCh[:SCALar]:POWer:NBURst:GMSK?
SAMPle[:SCALar]:POWer:NBURst:GMSK?
```

GMSK 8PSK

The *GMSK 8PSK* softkey toggles between GMSK modulation and 8PSK modulation (option CMU-K41 required).

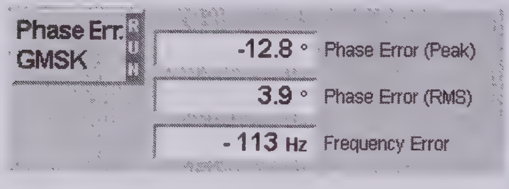
The currently selected modulation scheme is marked in inverse video (white typeface on a dark background). Selecting a modulation scheme also changes the *Power* and *Phase Error* panels of the *Analyzer/Generator* menu.

Remote control

GMSK and 8PSK modulation is selected by the keywords `:GMSK` and `:EPSK` in the command headers, respectively.

Phase Error GMSK Panel

The *Phase Error GMSK* panel is available if GMSK modulation is selected (see *GMSK 8PSK* softkey above). With 8PSK modulation, it is replaced by the *EVM 8PSK* panel; see page 4.5.



Phase Err. GMSK RUN

-12.8 ° Phase Error (Peak)

3.9 ° Phase Error (RMS)

- 113 Hz Frequency Error

The *Phase Error GMSK* panel contains three output fields indicating the maximum phase error *(Ph. Error Peak)*, the RMS phase error averaged over a burst *(Ph. Error RMS)*, and the current frequency error *(Frequ. Error)*. These values are also indicated in the graphical measurement menu *Modulation* (see page 4.23 ff).

Phase Err. GMSK

The *Phase Err. GMSK* softkey controls the GMSK modulation measurement and indicates its status *(RUN | HLT | OFF)*.

This status can be changed after softkey selection (pressing once) by means of the *ON/OFF* key or the *CONT/HALT* key. The status of the measurement is unaffected upon switchover to other menus controlling a *Modulation* measurement, however, a running measurement is restarted.

Measurement configuration

Pressing the *Modulation* softkey twice opens the popup menu *Modulation Configuration* (see page 4.33).

Remote control

```
INITiate:MODulation:PERRor:GMSK
ABORt:MODulation:PERRor:GMSK
STOP:MODulation:PERRor:GMSK
CONTINUE:MODulation:PERRor:GMSK
```

Phase Error (Peak)

Extreme value of the phase error (minimum or maximum, whichever has the larger absolute value) of the current burst in degrees. The result can be positive or negative. As no comparison is made between different bursts the result does not depend on the repetition mode (single shot or continuous measurement).

Phase Error (RMS)

RMS phase error of the current burst in degrees.

Frequency Error

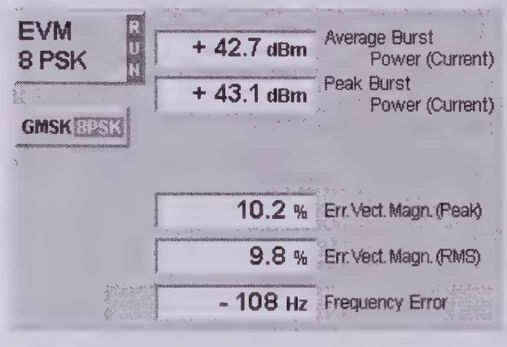
Frequency error of the current burst in Hz. As no comparison is made between different bursts the result does not depend on the repetition mode (single shot or continuous measurement).

Remote control

```
READ[:SCALar]:MODulation:PERRor:GMSK?
FETCh[:SCALar]:MODulation:PERRor:GMSK?
SAMPle[:SCALar]:MODulation:PERRor:GMSK?
```

EVM 8PSK Panel (Option CMU-K41 Required)

The *EVM 8PSK* panel is available if 8PSK modulation is selected (see *GMSK 8PSK* softkey above). With GMSK modulation, it is replaced by the *Phase Err. GMSK* panel; see page 4.4.



+ 42.7 dBm Average Burst Power (Current)
+ 43.1 dBm Peak Burst Power (Current)
10.2 % Err.Vect.Magn.(Peak)
9.8 % Err.Vect.Magn.(RMS)
- 108 Hz Frequency Error

The *EVM 8PSK* panel indicates the average and peak power of the current burst and lets you switch over to GMSK modulation (see section *Power Panel* on page 4.3). Besides, it contains three output fields indicating the maximum Error Vector Magnitude (EVM, *Err. Vect. Magn. (Peak)),* the RMS-averaged EVM (*Err. Vect. Magn. (RMS)),* and the frequency error *(Frequency Error)* of the current burst. These values are also indicated in the graphical measurement menu *Modulation* (see page 4.23 ff).

EVM 8PSK

The *EVM 8PSK* softkey controls the 8PSK modulation measurement and indicates its status *(RUN | HLT | OFF).*

This status can be changed after softkey selection (pressing once) by means of the *ON/OFF* key or the *CONT/HALT* key. The status of the measurement is unaffected upon switchover to other menus controlling a *Modulation* measurement, however, a running measurement is restarted.

Measurement configuration

Pressing the *EVM 8PSK* softkey twice opens the popup menu *Modulation Configuration* (see page 4.33).

Remote control

```
INITiate:MODulation:OVERview:EPSK
ABORt:MODulation:OVERview:EPSK
STOP:MODulation:OVERview:EPSK
CONTINUE:MODulation:OVERview:EPSK
```

Err. Vect. Magn. (Peak)

Extreme value of the Error Vector Magnitude (minimum or maximum, whichever has the larger absolute value) of the current burst in degrees. The result can be positive or negative. As no comparison is made between different bursts the result does not depend on the repetition mode (single shot or continuous measurement).

Err. Vect. Magn. (RMS)

RMS-averaged EVM of the current burst in degrees. Quadratic averaging was chosen to keep the result comparable with RMS averages of related quantities with alternating sign (e.g. the phase error, see section *Phase Error GMSK Panel* on page 4.4).

Frequency Error

Frequency error of the current burst in Hz. As no comparison is made between different bursts the result does not depend on the repetition mode (single shot or continuous measurement).

Remote control

```
READ[:SCALar]:MODulation:OVERview:EPSK?
FETCh[:SCALar]:MODulation:OVERview:EPSK?
SAMPle[:SCALar]:MODulation:OVERview:EPSK?
```

Power Measurements

The menu group *Power* comprises the functions for measuring the power of the received RF burst signal as a function of time. The power within a burst, the averaged power and its evolution over several consecutive slots or frames can be analyzed. The measurement results are displayed in the measurement menu *Power,* the popup menu *Power Configuration* is used for configuration of the measurements.

The ***P/t Normal ...*** (burst power versus time) application measures the output power of the DUT over one burst period. The measurement curve obtained can be further processed to determine an average, minimum, or maximum result and calculate the average over the whole burst. *P/t* measurements are provided for normal bursts at GMSK or 8PSK modulation; the latter require option CMU-K41 to be installed.

In addition to the burst power measurement, a limit check with tolerances depending on the RF output power of the DUT and the modulation scheme is performed. The results are output in tabular form.

In all applications, the CMU measures at arbitrary RF input powers provided that they are within the allowed range of the RF input connectors.

Measurement Menu (*Power*)

The graphical measurement menu *Power* shows the results of the burst analysis (power measurement).

- The main softkey *P/t Norm. GMSK,* which changes to *P/t Norm. 8PSK,* depending on the power measurement application and on the modulation scheme selected) controls the power measurement, indicates its status *(RUN | HLT | OFF)* and opens the configuration menu *Power Configuration.*
- The other softkeys to the right of the test diagram are combined with various hotkeys (the *hotkeys Channel, Frequency,* and *Frequency Offset* are associated with the softkey *Frequency* in the example below*)*. The softkey/hotkey combinations provide test settings and switch over between different measurements.

The measurement menu *Power* is opened from the main menu *Menu Select* (with the associated key at the front of the instrument) or using the *Power/t* hotkey.

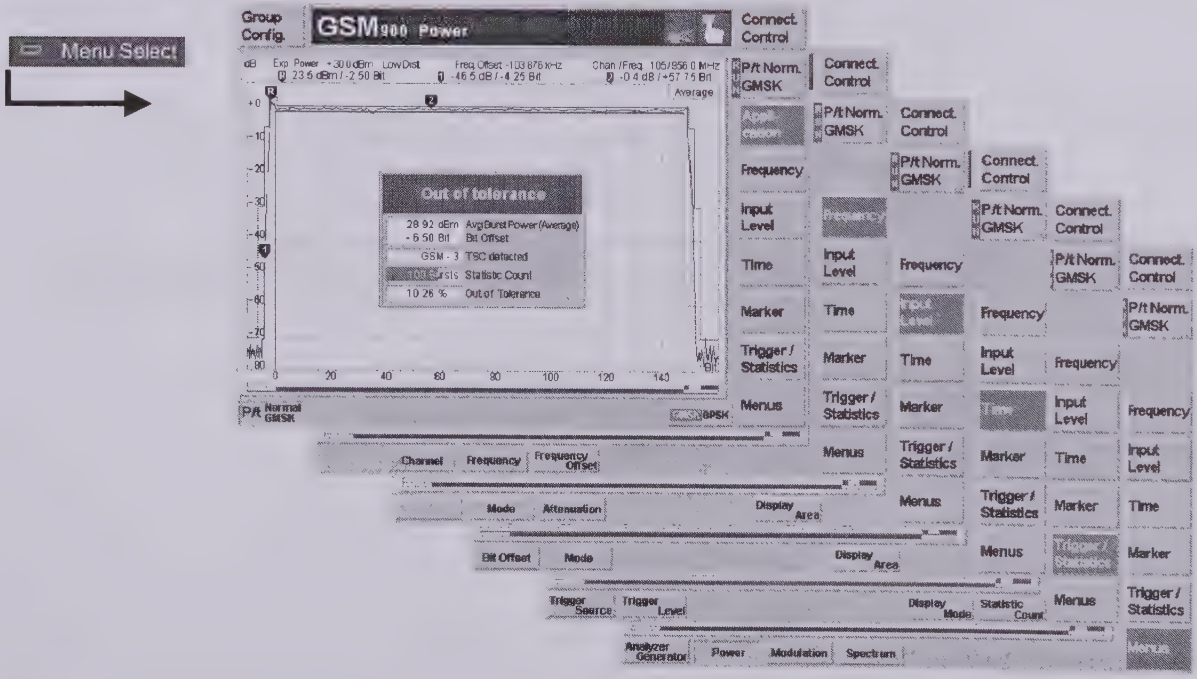

Menu Select
Group Config.
GSM900 Power
Connect. Control
dB Exp Power +30.0 dBm LowDist
23.5 dBm / -2.50 Bit
Freq. Offset -103.876 kHz
-46.5 dB / -4.25 Bit
Chan / Freq. 105/956.0 MHz
-0.4 dB / +57.75 Bit
Average
Out of tolerance
28.92 dBm Avg.Burst Power (Average)
- 6.50 Bit Bit Offset
GSM - 3 TSC detected
100 Bursts Statistic Count
10.26 % Out of Tolerance
0 20 40 60 80 100 120 140 Bit
P/t Normal GMSK
8PSK
P/t Norm. GMSK
Appl. Factor
Frequency
Input Level
Time
Marker
Trigger / Statistics
Menus
Channel
Frequency
Frequency Offset
Mode
Attenuation
Display Area
Bit Offset
Mode
Display Area
Trigger Source
Trigger Level
Display Mode
Statistic Count
Analyzer Generator
Power
Modulation
Spectrum

Fig. 4-2 Measurement menu Power

Test settings

The basic settings for the *Power* measurement are directly accessible from the measurement menu via softkey/hotkey combinations. If a softkey is selected and an associated hotkey is pressed, a popup window will appear which indicates the current setting and enables an entry.

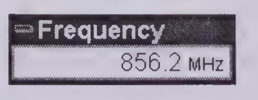
Example:

Frequency

The *Frequency* softkey displays a hotkey bar including the hotkey *Frequency*.

Frequency

The *Frequency* hotkey opens the input window *Frequency*.



Frequency

856.2 MHz

Input windows indicate the current parameter value (in this case: the current RF input frequency) or a list of the possible settings. Parameters are changed by

- overwriting/incrementing numerical values (for numerical parameters)
- selecting from the list of parameters (for select parameters)

Many of the basic settings are also accessible from the *Power Configuration* popup menu. They are explained in more detail in the *Measurement Configurations (Power Configuration)* section on page 4.15 ff.

a) Selection of the Measurement Application

Application

The *Application* softkey lets you select the power measurement application and the modulation scheme.

The application *P/t Normal <Mod_Type>* can be combined with any of the modulation schemes *GMSK* or *8PSK*. The *Power* measurement menu changes as a function of the application selected; the corresponding measurement results are explained in section *Measurement Results* on page 4.13 ff.

P/t Normal GMSK

The *P/t Normal <Mod_Type>* hotkey selects the power versus time measurement for normal burst signals (see explanation of GSM burst structure at the beginning of section *Limit lines (Power Configuration – Limit Lines)* on page 4.18). The hotkey labeling changes according to the modulation scheme *(GMSK* or *8PSK)* selected.

Remote control

The *P/t Normal GMSK* application is selected by the keywords `:NBURst :GMSK` in the 3rd and 4th level of the `POWer` commands, e.g. `CONFigure:POWer :NBURst:GMSK...`

The *P/t Normal 8PSK* application is selected by the keywords `:NBURst:EPSK` in the 3rd and 4th level of the POWer commands, e.g. `CONFigure:POWer :NBURst:EPSK...`

GMSK 8PSK

The *GMSK 8PSK* softkey toggles between GMSK modulation and 8PSK modulation (option CMU-K41 required). The currently selected modulation scheme is marked in inverse video (white typeface on a dark background). Selecting a modulation scheme also changes the *P/t Norm. <Mod_Type>* hotkey and the *P/t Norm. <Mod_Type>* main softkey in the *Power* measurement menu.

Remote control

GMSK and 8PSK modulation is selected by the keywords `:GMSK` and `:EPSK` in the command headers, respectively.

Some of the following test settings depend on the application selected.

b) P/t Normal GMSK

All softkeys and hotkeys in the *P/t Normal GMSK* application are shown in Fig. 4-2 on page 4.6.

P/t Norm. GMSK

The *P/t Norm. GMSK* softkey controls the power measurement and indicates its status *(RUN | HLT | OFF)*.

This status can be changed after softkey selection (pressing once) by means of the *ON/OFF* key or the *CONT/HALT* key. The status of the measurement is unaffected upon switchover to other menus controlling a *Power* measurement, however, a running measurement is restarted.

Remote control

```
INITiate:POWer:NBURst:GMSK
ABORt:POWer:NBURst:GMSK
STOP:POWer:NBURst:GMSK
CONTINUE:POWer:NBURst:GMSK
```

Measurement configuration

Pressing the *P/t Norm. GMSK* softkey twice opens the popup menu *Power Configuration* (see page 4.15).

Frequency

The *Frequency* softkey sets the frequency of the RF signal analyzed.

The analyzer settings are described in more detail in section *Panel Analyzer Settings* on page 4.50.

Channel

The *Channel* hotkey defines the GSM channel number of the analyzed signal.

Remote control

```
[SENSe:]RFANalyzer:FREQuency <Frequency>
```

Frequency

The *Frequency* hotkey defines the frequency of the analyzed signal in MHz.

Remote control

```
[SENSe:]RFANalyzer:FREQuency <Frequency>
```

Frequency Offset

The *Frequency Offset* hotkey defines a frequency offset relative to the signal frequency or GSM channel frequency defined with the *Frequency* or *Channel* hotkeys.

Remote control

```
[SENSe:]RFANalyzer:FOFFset <Offset>
```

Input Level

The *Input Level* softkey controls the level in the RF input signal path and selects the display area in the test diagram.

The input level settings are described in more detail in section *Input Power (Group Configuration – Input Power)* on page 4.60.

Expected Power

The *Expected Power* hotkey determines the maximum input level in dBm.

Remote control `[SENSE:]EPOWer:VALue <Power>`

Mode

The *Mode* hotkey determines how the input level is defined.

Manual	Manual input via *Expected Power* hotkey
Auto	Automatic setting according to the average burst power of the applied signal.

Remote control `-[SENSE:]EPOWer:MODE MANual | AUTomatic`

Attenuation

The *Attenuation* hotkey selects a strategy for tuning the RF analyzer.

Normal	Input signal is kept unchanged
Low Noise	Enhanced mixer level. This setting ensures the full dynamic range of the CMU and is therefore recommended for *Power* and *Spectrum* measurements.
Low Distortion	Decreased mixer level. This setting ensures a high transmission reserve and is therefore recommended for *Modulation* measurements.

Remote control `[SENSE:]EPOWer:ATTenuation NORMal | LNOise | LDIStortion`

Disp.Area

The *Disp. Area* hotkey defines the displayed screen area.

It is possible to select either the complete burst (see Fig. 4-8), or a particular area:

Full Range	Display of complete burst in the time range –10 bit to 157 bit and levels between –80 dBc and 10 dBc
Useful Part	Full time range, measurement curve magnified around the reference level
Left Upper Corner	Measurement curve magnified around the left upper corner
Rising Edge	Full level range, time axis from –10 bit to 10 bit
Right Upper Corner	Measurement curve magnified around the right upper corner
Falling Edge	Full level range, time axis from 139 bit to 157 bit

The screen setting and the measurement do not affect each other.

Remote control No command, screen configuration only

Time

The *Time* softkey configures the abscissa (time axis).

Bit Offset

The *Bit Offset* hotkey shifts the burst by the entered number of bits.

The burst is shifted relative to the time axis and the tolerance template for the burst analysis, see section *Limit lines (Power Configuration – Limit Lines)* on page 4.18. Therefore, the value of *Bit Offs.* affects the result of the tolerance check.

The permissible value range depends on the positioning convention for the test diagram (see below, *Mode* hotkey).

Remote control `CONFigure:POWer:NBURst:GMSK:TIME:BOFFset <Offset>`

Disp. Area

The *Disp. Area* hotkey determines the displayed screen area, see above.

Remote control: No command, screen configuration only

Marker

The *Marker* softkey positions up to 3 markers and a D-line in the test diagram and reads their values.

Markers	are graphical tools for marking points on the trace and for numerical output of measured values. The measurement menu *Power* provides a reference marker and two further markers which permit to measure spacings (delta marker 1 and 2). The coordinates of the three markers are indicated in the format *Ordinate value (level)/abscissa value (time)* in a parameter line above the test diagram. The position of the reference marker is expressed in absolute units (level in dBm and time in bits), the delta marker in absolute or relative units (relative level in dB or time differences from the reference marker).
D-line	The D-line is a horizontal line that can be positioned to mark and read out an arbitrary level in the test diagram.

Ref R

The hotkey *Ref. R* switches the reference marker on or off.

The reference marker is represented by the symbol R in the test diagram. The marker position (abscissa) is defined in the input field *Ref. Marker R*. The marker can be positioned to arbitrary time values. It is switched off in the default setting *(Off)*. The marker level is given by the measurement curve at the marker position.

The position of all markers can be varied using the roll-key.

Remote control: No command, screen configuration only

Rel 1

The *Rel. 1* hotkey switches the delta marker 1 on or off (use the *ON/OFF* key).

The delta marker 1 is represented by the symbol 1 in the test diagram. The marker position (abscissa) is defined in the input field *Rel. Marker 1*. The marker can be positioned to arbitrary time values. If its position is outside the diagram area it will be invisible and its coordinates will be "<abscissa_value> / - - -". The marker is switched off in the default setting *(Off)*. The marker level is given by the measurement curve at the marker position.

The toggle switch *Rel 1 Config* pops up when the hotkey is pressed for the second time. It defines whether the position of delta marker 1 is measured and indicated in absolute units (dBm) or relative to the reference marker.

Remote control: No command, screen configuration only

Rel 2

The *Rel. 2* hotkey switches the delta marker 2 on or off (use the *ON/OFF* key).

Functions and remote control are analogous to delta marker 1.

D-Line

The *D-Line* hotkey switches the D-line in the test diagram on or off.

The D-line is a horizontal, colored auxiliary line in the test diagram and is used for marking a level value and for measuring level differences. The level (ordinate) is defined in the input field *D-Line*. The D-line can be positioned in the whole diagram area, the default setting is *Off*.

The switch *D-Line Config.* pops up when the hotkey is pressed for the second time. It defines whether the D-line level is expressed in absolute units (in dBm, setting *absolute)* or relative to the *Expected Power* (in dB, setting *relative).*

Remote control

No command, screen configuration only

Trigger Statistics

The *Trigger/Statistics* softkey sets the trigger condition, the statistics mode and the number of statistics cycles.

The trigger settings are described in more detail in section *Trigger (Group Configuration – Trigger)* on page 4.62.

Trigger Source

The *Trg. Src.* hotkey determines the trigger condition.

Free Run	Triggering via TDMA timing (synchronization information in bit 13/14 of the training sequence)
RF Power	Triggering on power (rising edge) of incoming burst, broadband trigger at front end
IF Power	Narrow-band trigger
Extern	External trigger signal fed in via connector AUX3

Remote control

```
TRIGger[:SEQuence]:SOURce
             FRUN | RFPower | IFPower | EXTern
```

Trigger Level

The *Trigger Level* hotkey determines the trigger level.

This softkey is enabled for trigger source *RF Power* or *IF Power* only.

Remote control

```
TRIGger[:SEQuence]:THReshold LOW | MEDium | HIGH
```

Display Mode

The *Display Mode* hotkey determines the display mode.

See section *Statistics Cycles (Power Configuration* – Statistics) on page 4.21.

Remote control

no display mode set, the four traces are accessible via

```
FETCh:ARRAy:POWer:NBURSt:GMSK:CURRent?
FETCh:ARRAy:POWer:NBURSt:GMSK:MINimum?
FETCh:ARRAy:POWer:NBURSt:GMSK:MAXimum?
FETCh:ARRAy:POWer:NBURSt:GMSK:AVERage?
```

etc.

Statistic Count

The hotkey *Statistic Count* defines the number of bursts per statistic cycle.

1 to 1000 Bursts Number of bursts per statistics cycle,
See section *Statistics Cycles (Power Configuration* – Statistics) on page 4.21.

Remote control

```
CONFigure:POWer:NBURSt:GMSK:CONTrol:STATistics
               1 ... 1000 | NONE
```

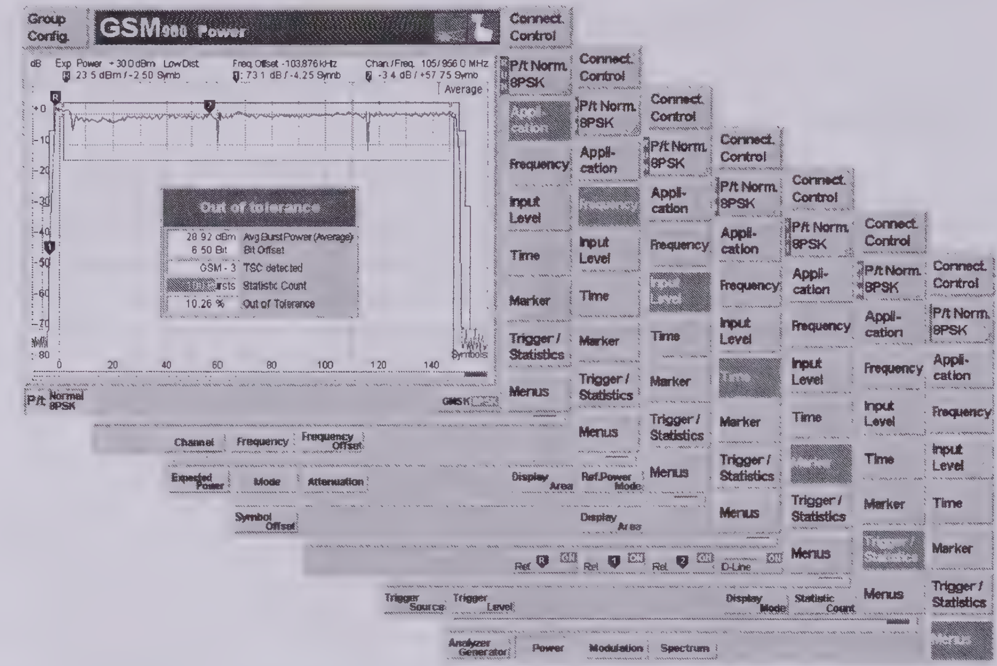
Menus

The *Menus* softkey displays the hotkey bar for changing to the other measurement menus.

c) P/t Normal 8PSK (Option CMU-K41 required)

As shown in Fig. 4-3 below, the *P/t Normal 8PSK* application differs from the *P/t Normal GMSK* application in three softkeys.

Appli-
cation
P/t Normal 8PSK


Group Config.
GSM900 Power
Connect. Control
P/t Norm. 8PSK
Appli-cation
Frequency
Input Level
Time
Marker
Trigger / Statistics
Menus
Out of tolerance
P/t Normal 8PSK
GMSK
Channel
Frequency
Frequency Offset
Expected Power
Mode
Attenuation
Display Area
Ref.Power Mode
Symbol Offset
Ref. R ON
Ref. 1 ON
Ref. 2 ON
D-Line ON
Trigger Source
Trigger Level
Display Mode
Statistic Count
Analyzer Generator
Power
Modulation
Spectrum
dB
Symbols
Average

Exp. Power +30.0 dBm LowDist
R: 23.5 dBm / -2.50 Symb
Freq. Offset -103.876 kHz
1: 73.1 dB / -4.25 Symb
Chan./Freq. 105 / 956.0 MHz
2: -3.4 dB / +57.75 Symb

28.92 dBm Avg.Burst Power (Average)
6.50 Bit Bit Offset
GSM - 3 TSC detected
Bursts Statistic Count
10.26 % Out of Tolerance

Fig. 4-3 Measurement menu Power – P/t Norm. 8PSK

P/t Norm. 8PSK

The *P/t Norm. 8PSK* softkey controls the power measurement and indicates its status *(RUN | HLT | OFF)*.

This status can be changed after softkey selection (pressing once) by means of the *ON/OFF* key or the *CONT/HALT* key. The status of the measurement is unaffected upon switchover to other menus controlling a *Power* measurement, however, a running measurement is restarted.

Remote control

```
INITiate:POWer:NBURst:EPSK
ABORt:POWer:NBURst:EPSK
STOP:POWer:NBURst:EPSK
CONTINUE:POWer:NBURst:EPSK
```

Measurement configuration

Pressing the *P/t Norm. 8PSK* softkey twice opens the popup menu *Power Configuration* (see page 4.15).

Input Level

The *Input Level* softkey controls the level in the RF input signal path, selects the display area, and defines how the reference power is calculated.

The *Expected Power, Mode, Attenuation,* and *Display Area* softkeys behave as described in section *P/t Normal GMSK* on page 4.8 ff. With 8PSK modulation, there is one additional hotkey:

Ref Power Mode

The *Ref. Power Mode* hotkey defines whether the reference power (0-dB line) in the measurement diagram is derived from the average power of the current measurement curve *(Current)*, the average power of the average curve *(Average)*, or the average power of the current curve with an additional correction for the deviation due to the data modulated onto the RF signal *(Data Compens.)*. See section *Measurement Control (Power Configuration – Control)* on page 4.15.

Remote control

```
CONFigure:POWer:NBURst:EPSK:CONTrol:RPMode
  CURRent | AVERage | DCOMpens
```

Besides, the timing offset is expressed in symbol periods; the *Bit Offset* hotkey assigned to the *Time* softkey is replaced by *Symbol Offset*. 8PSK symbols and GMSK bits have the same transmission rate, see explanation of GSM burst structure at the beginning of section *Limit lines (Power Configuration – Limit Lines)* on page 4.18.

Measurement Results

The measurement results depend on the application selected.

a) P/t Normal GMSK

The values shown in the measurement menu *Power*, application *P/t Normal GMSK,* can be divided into three groups:

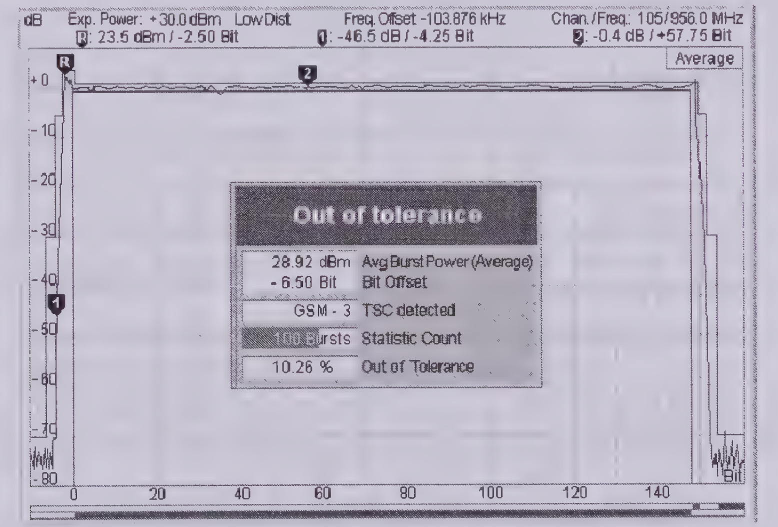
- Settings
- Scalar measurement results (single values)
- Arrays (the measurement curve plotted as a function of time)

These values are indicated in two parameter lines, the test diagram and an info box:

Parameter line 1, 2

Test diagram

Info box



dB Exp. Power: +30.0 dBm LowDist Freq. Offset -103.876 kHz Chan./Freq.: 105/956.0 MHz

R: 23.5 dBm / -2.50 Bit 1: -46.5 dB / -4.25 Bit 2: -0.4 dB / +57.75 Bit

Out of tolerance

28.92 dBm Avg Burst Power (Average)

- 6.50 Bit Bit Offset

GSM - 3 TSC detected

100 Bursts Statistic Count

10.26 % Out of Tolerance

Fig. 4-4 Display of results (Power – P/t Norm. GMSK)

Settings/ scalar measurement results Settings and scalar measurement results are indicated in the two parameter lines above the test diagram and in the info box, a popup window in the middle of the graphical screen *Power*.

1st parameter line The first parameter line contains the following settings:

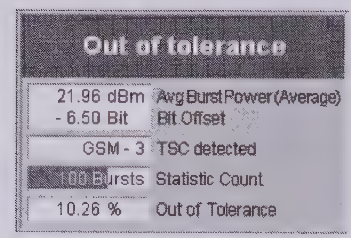
Expected Power	Maximum value of input level as set in *Input Power – Expected Power* (see p. 4.60).
Attenuation	Setting for the attenuation of the input level *(Normal, Low Noise, Low Distortion)* as set in *Group Config. – Input Power* (see p. 4.60).
Freq. Offset	Frequency offset with respect to the nominal channel frequency
Chan./Freq.	RF channel and associated frequency

2nd parameter line

The second parameter line contains the following marker values:

R	Power and time of reference marker
1	Power and time of delta marker 1 (setting *absolute*) or difference from reference marker (setting *relative*)
2	Power and time of delta marker 2 (setting *absolute*) or difference from reference marker (setting *relative*)

Info box



Out of tolerance

21.96 dBm	Avg Burst Power (Average)
- 6.50 Bit	Bit Offset
GSM - 3	TSC detected
100 Bursts	Statistic Count
10.26 %	Out of Tolerance

The info box contains the following settings:

Bit Offset	Shifting of the burst with respect to the time axis and the tolerance template. In *Signalling* mode, the measured delay shift is displayed instead.
Statistic Count	Number of bursts per statistics cycle.

In addition, the following scalar results are indicated:

Avg Burst Power	Average burst power, depending on the display mode set (see upper right corner of the diagram).
TSC detected	Training sequence of the measured RF burst *(GSM – 0 to 7 | Dummy | ---)*.
Out of Tolerance	Relative number of bursts that are out of the tolerances defined by the limit lines.
Burst Matching	Error message if the displayed burst is out of tolerance.

Remote control

Settings are read out using the query corresponding to the setting command (setting command with appended question mark).

For scalar measurement results:

```
READ[:SCALar]:POWer:NBURst:GMSK?
CALCulate[:SCALar]:POWer:NBURst:GMSK:MATChing:LIMit?
FETCh[:SCALar]:POWer:NBURst:GMSK?
SAMPle[:SCALar]:POWer:NBURst:GMSK?
```

Traces (arrays)

The measurement result is displayed as a continuous measurement curve in the test diagram together with the limit lines, markers and the D-line, if defined. The curve is derived from 668 equidistant measurement points with a ¼ bit spacing covering a time range between –10 bit and 156 ¾ bit.

The measurement curve in the *Power* measurement menu shows the measured burst power (in dB) as a function of time (in bits). The displayed result depends on the test settings. The display mode for the measurement curve *(Minimum, Maximum, Average, Current)* is indicated in the upper right corner of the diagram. The scale of both axes can be adjusted via the *Display Area* hotkey (see above).

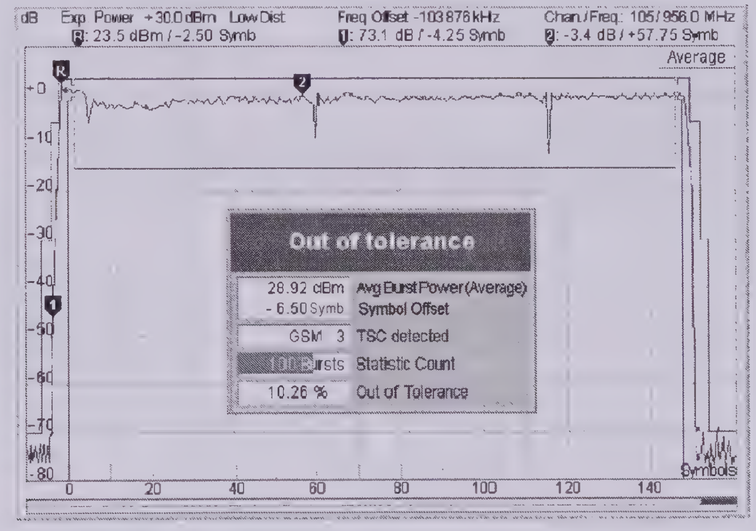
Remote control

```
READ:ARRay:POWer:NBURst:GMSK...?
CALCulate[:SCALar]:POWer:NBURst:GMSK:MATChing:LIMit?
FETCh:ARRay:POWer:NBURst:GMSK...?
SAMPle:ARRay:POWer:NBURst:GMSK...?
```

b) P/t Normal 8PSK (Option CMU-K41 Required)

As shown in Fig. 4-5 below, the *P/t Normal 8PSK* measurement results are similar to the *P/t Normal GMSK* results. The differences are:

- With 8PSK modulation, the time axis is scaled in symbol periods. 8PSK symbols and GMSK bits have the same transmission rate, see explanation of GSM burst structure at the beginning of section *Limit lines (Power Configuration – Limit Lines)* on page 4.18.
- The default limit lines differ from the GMSK limit lines.



Parameter line 1, 2

Test diagram

Info box

dB Exp. Power +30.0 dBm Low Dist Freq Offset -103.876 kHz Chan./Freq.: 105 / 956.0 MHz
R: 23.5 dBm / -2.50 Symb 1: 73.1 dB / -4.25 Symb 2: -3.4 dB / +57.75 Symb

Out of tolerance

28.92 dBm	Avg Burst Power (Average)
- 6.50 Symb	Symbol Offset
GSM 3	TSC detected
100 Bursts	Statistic Count
10.26 %	Out of Tolerance

Fig. 4-5 Display of results (Power – P/t Norm. 8PSK)

Measurement Configurations (*Power* Configuration)

The popup menu *Power Configuration* contains three index cards that determine the parameters controlling the power measurement including the tolerance limits.

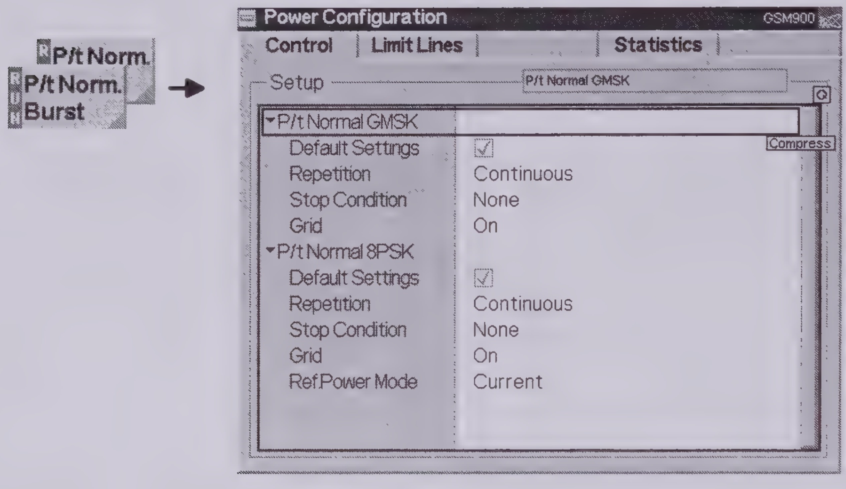
The popup menu *Power Configuration* is activated by pressing the softkey *Power/t* at the top right in the graphical measurement menu *Power* twice. It is possible to change between the tabs by pressing the associated hotkeys.

Measurement Control (*Power* Configuration – Control)

The tab *Control* controls the power measurement by determining

- The *Repetition* mode
- The *Stop Condition* for the measurement
- The averaging prescription to obtain the reference power *(Ref. Power Mode* , for *P/t Norm. 8PSK* measurements only)

Besides, it configures the diagram by adding or removing the *Grid.*



P/t Normal GMSK
Default Settings ☑
Repetition Continuous
Stop Condition None
Grid On
P/t Normal 8PSK
Default Settings ☑
Repetition Continuous
Stop Condition None
Grid On
Ref.Power Mode Current

Fig. 4-6 Power Configuration – Control

The settings can be defined separately for the different applications of the *Power* measurement group.

Default Settings The *Default Settings* switches assign default values to all parameters of a particular modulation scheme. The default values are quoted in the command description in chapter 6 of this manual.

Remote Control `DEFault:POWer:NBURst:GMSK:CONTrol ON | OFF etc.`

Repetition The *Repetition* field determines the repetition mode:

Single Shot Single-shot measurement: the measurement is stopped after a statistics cycle, or after a stop condition is met. A stopped measurement is indicated by the status display *HLT* in the softkey *Power*.

For *Power* measurements, a statistics cycle corresponds to the number of bursts/evaluation periods set under *Statistic Count*. Otherwise, a statistics cycle lasts until all measurement results have been acquired (i.e. it comprises the total number of slots or frames measured).

Continuous Continuous measurement: The CMU continues the measurement until it is terminated explicitly or until the stop condition (see below) for the measurement is met. The measurement results are valid after one statistic cycle; however, the measurement is continued, and the output is continuously updated. An ongoing measurement is indicated by the status display *RUN* in the softkey *Power*.

Single shot should be selected if only a single measurement result is required under fixed conditions. The continuous measurement is suitable for monitoring the evolution of a measured quantity in time, for example for adjustments.

Note: *In remote mode, the counting measurement (counting mode) is available as a further measurement mode with a defined number of measurement cycles to be performed, see chapter 6 of this manual.*

Remote control `CONFigure:POWer:NBURst:GMSK:CONTrol:REPetition CONTinuous | SINGleshot | 1 ... 10000,<StopCondition>,<Stepmode>` etc.

Stop Condition The *Stop Condition* table row defines a stop condition for the measurement:

NONE	Continue measurement even in case of error
On Limit Failure	Stop measurement in case of error (tolerance exceeded)

Remote control

```
CONFigure:POWer:NBURst:GMSK:CONTrol:REPetition
          <Repetition>,SOERrror | NONE, <Stepmode> etc.
```

Grid The *Grid* table row switches the grid on or off in the graphical test diagram. By default, the grid is switched on.

Remote control No command, screen configuration only

Ref. Power Mode The input field *Ref. Power Mode* determines how the reference power, i.e. the 0-dB line in the measurement diagram, is calculated.

Current	The reference power depends on the *Display Mode* set. It is equal to the average power of the *Current* measurement curve (display mode *Current)* or to the average power of the *Average* measurement curve (display mode *Average, Maximum, or Minimum)*.
Average	The reference power is equal to the average power of the average measurement curve.
Data Compens.	The reference power depends on the *Display Mode* set. It is equal to the data-compensated average power of the *Current* measurement curve (display mode *Current)* or to the data-compensated average power of the *Average* measurement curve (display mode *Average, Maximum, or Minimum)*.

Owing to the characteristics of 8PSK modulation, the amplitude of the RF signal varies according to the data transmitted. As a consequence, only the long term average of the power when taken over the useful part of the burst for random data represents a correct measure for the output power of the base station. This long time average (rather than the average power of the current burst) is also the correct reference level (0-dB line) for the *P/t Norm. 8PSK* measurement.

The *Average* setting ensures that a correct reference power is used, however, averaging results in a longer measurement time. In the *Data Compensated* mode, a known data sequence is used to correct the measured average power of the current burst and estimate the correct reference power. Delays due to averaging are avoided.

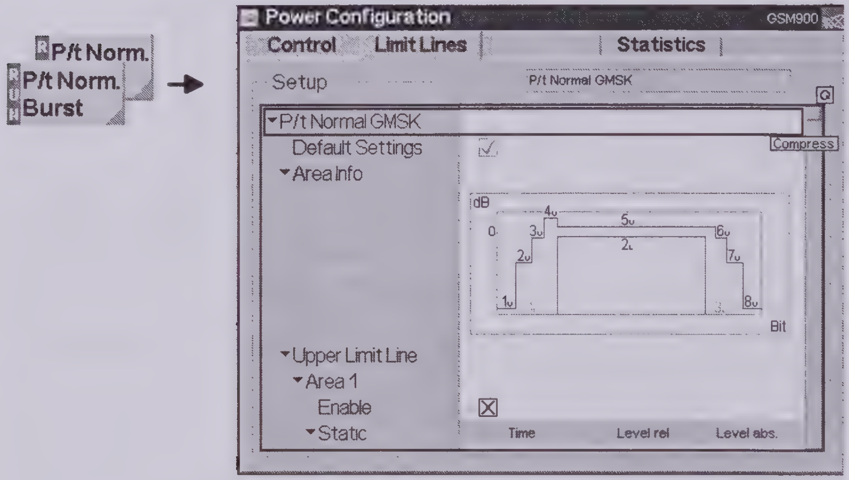
Remote control

```
CONFigure:POWer:NBURst:EPSK:RPMode
  CURRent | AVERage | DCOMpens
```

Limit lines (Power Configuration – Limit Lines)

The tab *Limit Lines* defines the limit lines for the *Power* measurements (applications *P/t Norm. GMSK* and *P/t Norm. 8PSK*). Limit lines are a graphical tool for defining and monitoring the tolerance values. The tab enables

- A diagram showing showing the different limit line areas defined in GSM *(Area Info)*
- Definition of the limit lines for the normal burst section by section *(Upper Limit Line, Lower Limit Line)*



Setup P/t Normal GMSK

- P/t Normal GMSK
  - Default Settings ☑
  - Area Info
  - Upper Limit Line
    - Area 1
      - Enable ☒
      - Static — Time Level rel Level abs.

Fig. 4-7 Power Configuration – Limit Lines

Burst structure in GSM mobile radio network:

GMSK modulation

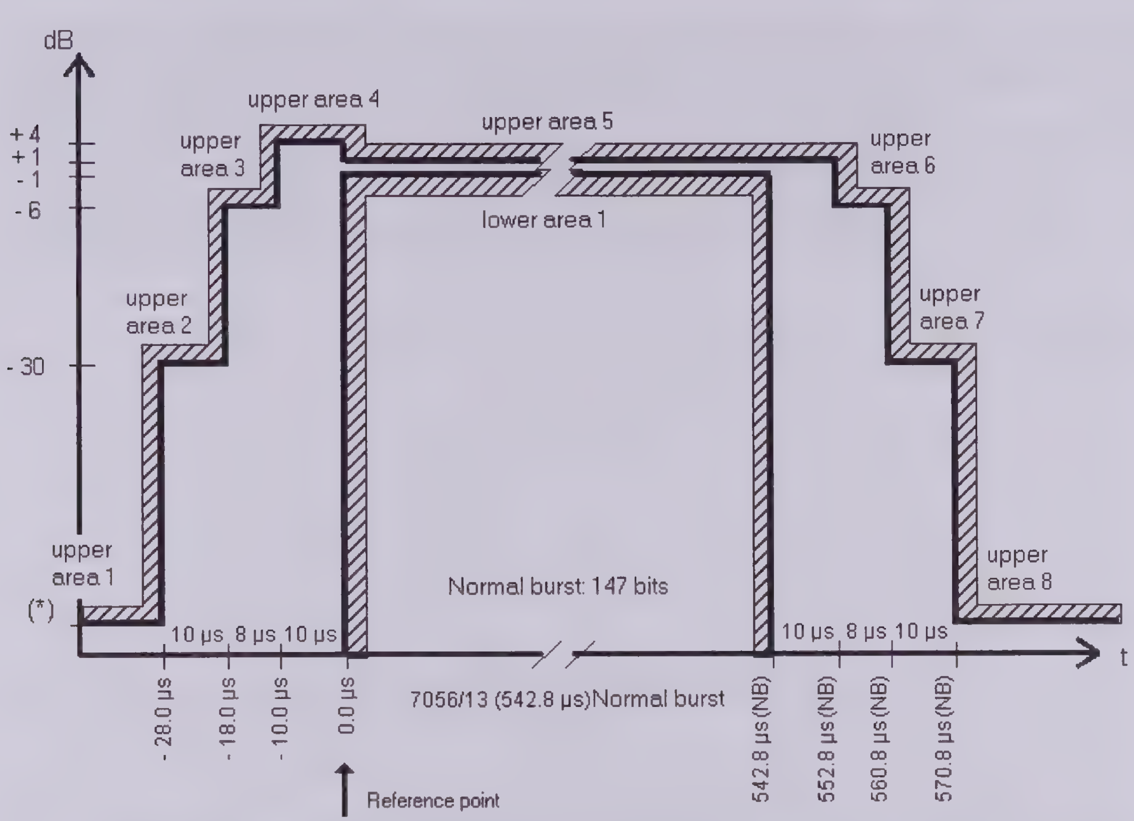
In the GSM mobile radio network, all radio channels are divided into frames with 8 timeslots, each with a duration of 15/26 ms ≈ 577 µs. In this time mask, various bursts types can be transmitted. The GSM standard specifies the carrier power versus time for two burst types of different length:

Normal burst (NB)	Data transmission in the traffic channel and in the control channels except RACH. The useful part of the normal burst comprises 157 bits.
Access burst (Access Burst)	Allows the mobile (MS) first access to the base station (BTS) in order to determine the timing advance. The useful part of the access burst comprises 87 bits. This burst type is not used in BTS tests.

The data transmission rate in GSM is 270.833 kbit/s, resulting in a bit duration of 3.69 µs/bit. The bit structure of the normal burst is shown in Fig. 4-31.

As a function of time, the power ramp for normal (NB) and access bursts (AB) can be divided into different areas. These areas serve as a basis for the definition of the limit lines and are shown in the following diagram Fig. 4-8.

Note: *The burst type analyzed in the* Non Signalling *mode is the normal burst. The reference power (0 dB line) is equal to the received transmitter carrier power, i.e. the average value of the transmitter carrier power over the useful part of the burst as received by the CMU. The burst is fitted into the tolerance template such that the transition between bit 13/14 of the training sequence corresponds to the center of the useful part of the burst. This timing reference can be modified via the* Time *softkey, see section* Test settings *on page 4.7.*


dB
+4
+1
-1
-6
-30
(*)
upper area 1
upper area 2
upper area 3
upper area 4
upper area 5
lower area 1
upper area 6
upper area 7
upper area 8
Normal burst: 147 bits
10 µs 8 µs 10 µs
10 µs 8 µs 10 µs
t
- 28.0 µs
- 18.0 µs
- 10.0 µs
0.0 µs
7056/13 (542.8 µs)Normal burst
542.8 µs (NB)
552.8 µs (NB)
560.8 µs (NB)
570.8 µs (NB)
Reference point

(*) No requirement for BTS below –30 dBc. If bursts are transmitted in a series of consecutive time slots, no requirements are specified to the power ramping in the guard times between the active slots, but the tolerance template shall be respected at the beginning and the end of the series of consecutive bursts (GSM 05.05).

Fig. 4-8 Tolerance mask (limit lines) for normal and access bursts (BTS) at GMSK modulation according to GSM specifications (GSM400/900/1800)

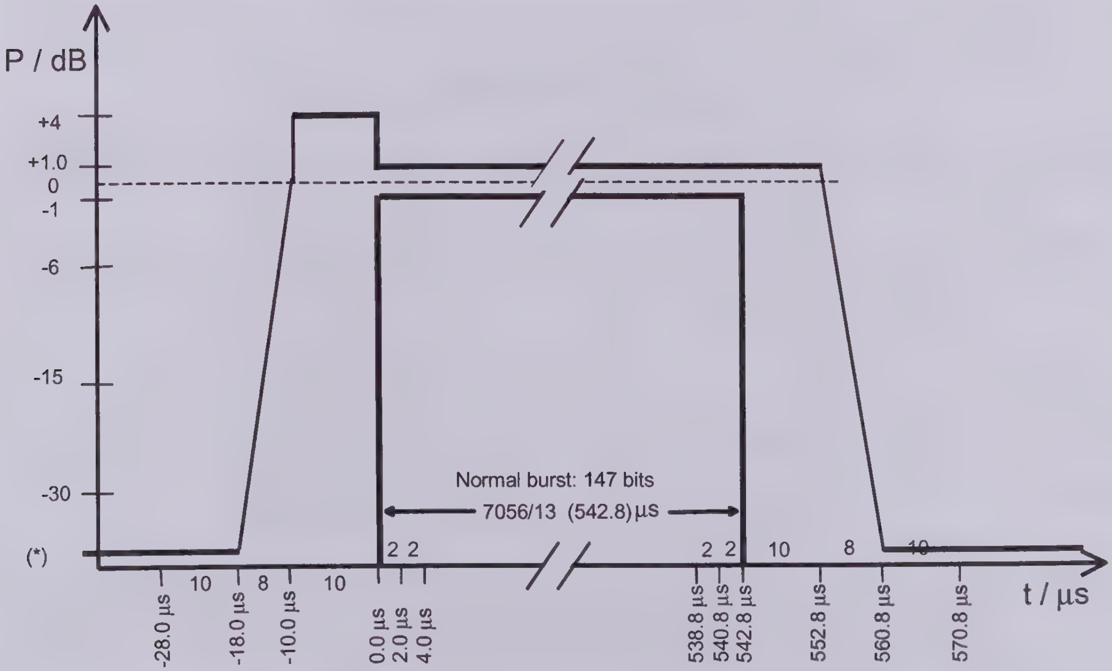

P / dB
+4
+1.0
0
-1
-6
-15
-30
(*)
Normal burst: 147 bits
7056/13 (542.8) µs
2 2
2 2
10
8
10
10
8
10
t / µs
-28.0 µs
-18.0 µs
-10.0 µs
0.0 µs
2.0 µs
4.0 µs
538.8 µs
540.8 µs
542.8 µs
552.8 µs
560.8 µs
570.8 µs

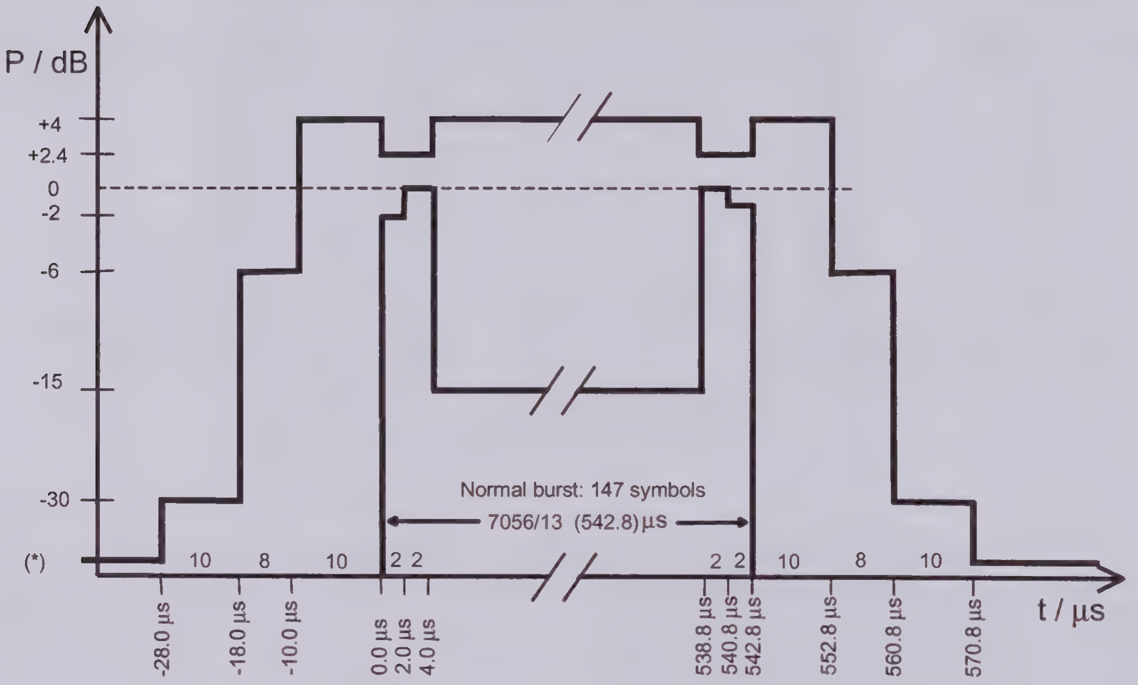
Fig. 4-9 Tolerance mask (limit lines) for normal bursts (BTS) at GMSK modulation according to GSM specifications (GSM1900)

Burst structure in GSM mobile radio network:

8PSK modulation

8PSK modulation was introduced to GSM with release 1999 (GSM 05.05 version 7.1.0). 8PSK channels (the so-called EDGE channels) are used for data transmission; only normal bursts are transmitted. The modulating symbol rate is the same as in GMSK modulation (270.833 ksymb/s), which corresponds to a bit rate of 3 x 270.833 kbit/s. The CMU uses the same time scale for both modulation schemes; a bit duration in GMSK modulation is equal to a symbol duration in 8PSK modulation.

The power template for 8PSK burst differs from the GMSK power template but is equal for all GSM bands; see Fig. 4-10 below.



(*) No requirement for BTS below –30 dBc.

Fig. 4-10 GSM tolerance template for normal bursts (BTS) at 8PSK modulation (for all GSM bands, GSM05.05 version 8.5.0 or GSM11 .21 version 8.3.0)

The limit lines for GMSK and 8PSK modulation are set in separate table sections but in an analogous way. Note that 8PSK measurements require option CMU-K41:

Default Settings

The *Default Settings* switches assign default values to all parameters of a particular modulation scheme. The default values are quoted in the command description in chapter 6 of this manual.

Remote control `DEFault:POWer:NBURst:GMSK:LIMit:LINE ON | OFF` etc.

Area Info

The *Area Info* diagram represents the GSM tolerance template.

Remote control –

Upper Limit Line

The table *Upper Limit Line* defines the upper limit lines for normal bursts. The normal burst can be divided into up to 16 areas *(Area 1 to Area 16)*; within an area, the limit line represents a line section with arbitrary (even infinite) slope.

The individual entries in the table field *Upper Limit Line* have the following meaning:

Area 1 etc. Area number, by default 8 enabled areas as in Fig. 4-8.

Enable	Switches the limit line in the corresponding area and the limit check on or off.
Time	Start and (below) stop time of the section in bits.
Level rel. [dB]	Start and (below) stop level of the section in units relative to the carrier. This means that the reference level (0-dB line) is the carrier power averaged over the useful part of the burst.
Level abs. [dBm]	Start and (below) stop level of the section in absolute units (dBm).

The input of relative and absolute limit values is optional; both can be switched off for valid areas (setting *Off*). If both absolute and relative limit values are specified in an area, the tolerance template and the results of the limit check refer to the **looser** criterion.

The permissible ranges for the upper and lower limit lines, i.e. of the quantities *Time, Level rel.*, and *Level abs.* vary according to the area numbers, see command description in chapter 6.

Remote control

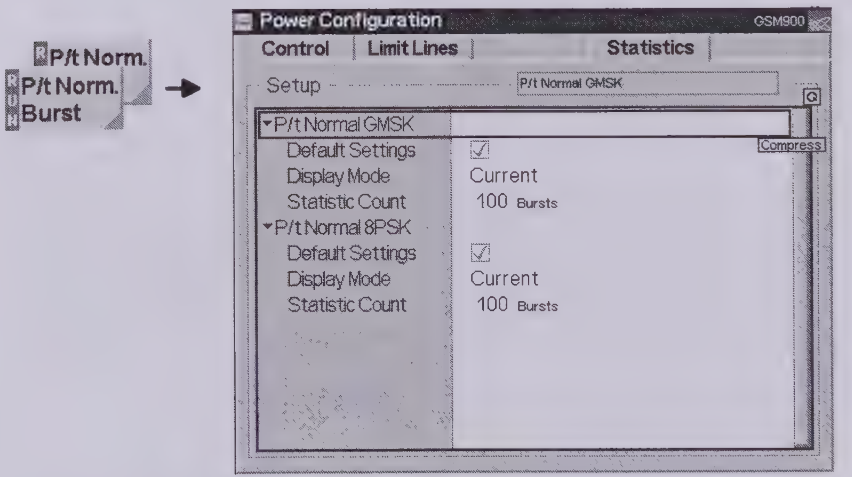
```
CONFigure:POWer:NBURst:GMSK:LIMit:LINE:ASYMmetric:UPPer:
AREA<nr> <StartTime>,<EndTime>,<StartRelLevel>,<EndRelLevel>,
      <StartAbsLevel>,<EndAbsLevel>,<Visibility>
```

Lower Limit Line The table *Lower Limit Line* defines the lower limit lines for normal bursts. All settings are analogous to the upper limit lines.

```
CONFigure:POWer:NBURst:GMSK:LIMit:LINE:ASYMmetric:LOWer:
AREA<nr>  <StartTime>,<EndTime>,<StartRelLevel>,<EndRelLevel>,
         <StartAbsLevel>,<EndAbsLevel>,<Visibility>
```

Statistics Cycles (Power Configuration – Statistics)

The tab *Statistics* defines the number of bursts/evaluation periods forming a statistics cycle *(Statistic Count)* and the power ramp displayed *(Display Mode)*.



Setup P/t Normal GMSK

P/t Normal GMSK
  Default Settings ☑
  Display Mode Current
  Statistic Count 100 Bursts
P/t Normal 8PSK
  Default Settings ☑
  Display Mode Current
  Statistic Count 100 Bursts

Fig. 4-11 Power Configuration – Statistics

Default Settings The *Default Settings* switches assign default values to all parameters of a particular modulation scheme. The default values are quoted in the command description in chapter 6 of this manual.

Remote control `DEFault:POWer:NBURst:GMSK:CONTrol ON | OFF` etc.

Display Mode The *Display Mode* table row defines which of the four measured and calculated traces is displayed. The traces differ in the way the burst power *p(t)* at a fixed point in time *t* is calculated if the measurement extends over several bursts:

Current	Measured value for current burst
Minimum	Minimum over a number of bursts
Maximum	Maximum over a number of bursts
Average	Average value over a number of bursts

The number of bursts for calculation of the statistics values *Minimum, Maximum* and *Average* – and thus the result – depends on the measurement mode set (see section *Measurement Control (Power Configuration* – Control) on page 4.15). In detail, this implies:

Single shot	Display of minimum, maximum and average value from the performed statistics cycle
Continuous	Display of minimum and maximum from all bursts already measured. The **average value**, however, is calculated according to the prescription in Chapter 3, section *General Settings*.

Remote control no display mode set explicitly, the four measurement curves are accessible via

```
FETCh:ARRAy:POWer:NBURst:GMSK:CURRent?
FETCh:ARRAy:POWer:NBURst:GMSK:MINimum?
FETCh:ARRAy:POWer:NBURst:GMSK:MAXimum?
FETCh:ARRAy:POWer:NBURst:GMSK:AVERage?
```
etc.

Statistic Count The table row *Statistic Count* defines the length of the statistics cycles in bursts.

1 to 1000 Bursts	Number of bursts per statistics cycle

A statistics cycle is equal to the duration of single-shot measurements (see section *Measurement Control (Power Configuration* – Control) on page 4.15).

Remote control

```
CONFigure:POWer:NBURst:GMSK:CONTrol:STATistics
        1 ... 1000 | NONE
```

Modulation Measurements

The menu group *Modulation* comprises the functions for measurement of the modulation parameters of the RF signal transmitted by the base station. The measurement results are displayed in the graphical measurement menu *Modulation,* the popup menu *Modulation Configuration* is used for configuration of the measurements.

The characteristics of the modulation measurement, the measured quantities and the measurement menus depend largely on the modulation scheme *(GMSK* or *8PSK* modulation) selected by means of the *Application – GMSK 8PSK* hotkey in the *Modulation* measurement menu. For the sake of clarity, the two modulation schemes are explained separately throughout the remainder of the *Modulation Measurements* section.

Measurement Menu (Modulation – GMSK)

If the GMSK modulation scheme is selected (see *Application* softkey in section *Test Settings* on page 4.24 ff), the graphical measurement menu *Modulation* displays the results of the phase and frequency error analysis.

- The main softkey *Phase Err. GMSK* indicates the measurement status *(RUN | HLT | OFF)* and opens the configuration menu *Modulation Configuration* (press twice). The hotkeys associated to the main softkey define the scope of the *Power* measurement.
- The other softkeys to the right of the test diagram are combined with various hotkeys. The softkey/hotkey combinations provide test settings and switch over between different measurements. The entry of values is described in section *Measurement Menu (Power)* on page 4.6.

The measurement menu *Modulation* can be accessed from any other measurement menu of function group *GSMxxxx-BS Non Signalling* using the *Modulation* hotkey. It can be opened also from the *Menu Select* main menu (with the associated key at the front of the instrument).

Frequency and phase errors are determined as follows:

The actual phase of the signal received from the base station is recorded during the entire burst and stored. The transferred data is demodulated and the training sequence searched for. The middle of the training sequence is used for time synchronization (transition between bit 13/14).

The complete data content of the burst is then mathematically modulated using an ideal modulator. The resulting ideal phase is compared with the measured phase. From the difference between the two quantities (the phase difference trajectory), a regression line is calculated using the Mean Square Error method. The *phase error* is the difference between the phase difference trajectory and the regression line; it is calculated and plotted over the whole useful part of the burst (147 bits for NB). The average *frequency error* in the burst is equal to the derivative of the regression line with respect to time.

For the **tolerance check** the phase error trajectory is fitted into the tolerance template and checked for tolerance violations. According to GSM specifications, a maximum peak phase error of $\pm 20^0$, a maximum RMS phase error of $\pm 5^0$, and a frequency error of 0.05 ppm referred to the carrier frequency is allowed.

The CMU evaluates the phase error with a resolution of 4 measured values per modulating bit. This corresponds to a sampling rate of approx. 1 MHz.

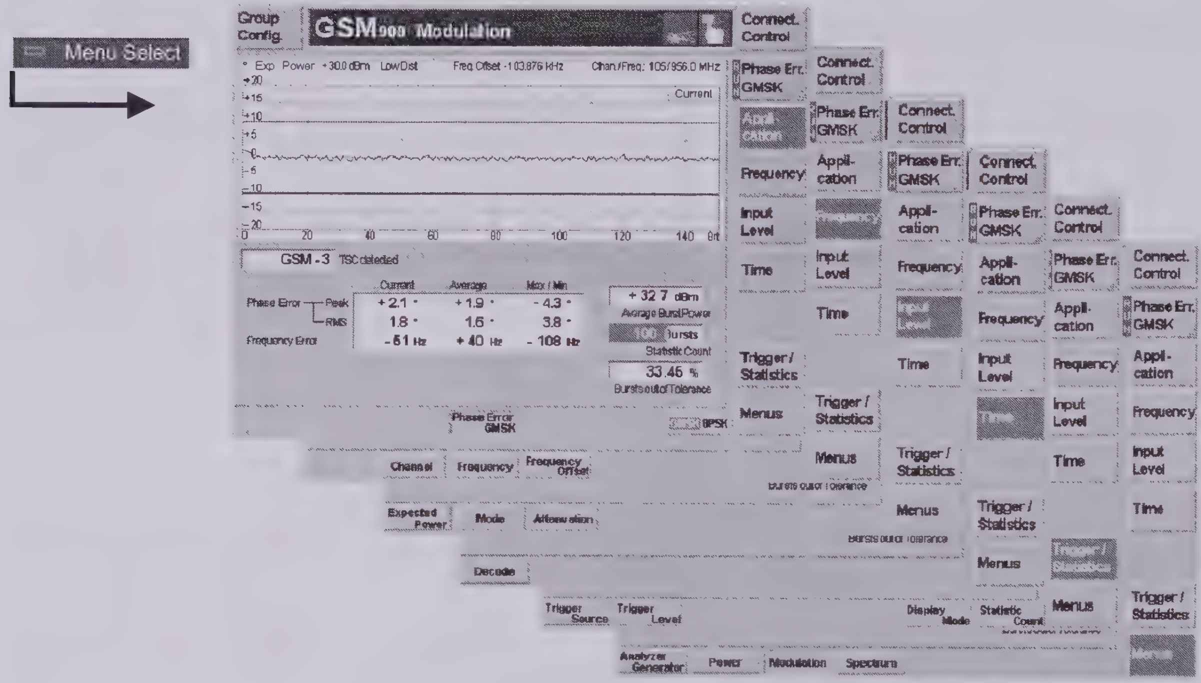

Menu Select
Group Config.
GSM900 Modulation
Connect. Control
Phase Err. GMSK
Appli-cation
Frequency
Input Level
Time
Trigger / Statistics
Menus
GSM-3 TSC detected
Current
Average
Max / Min
Phase Error Peak
RMS
Frequency Error
+2.1 °
+1.9 °
-4.3 °
1.8 °
1.6 °
3.8 °
-61 Hz
+40 Hz
-108 Hz
+32.7 dBm
Average Burst Power
100 Bursts
Statistic Count
33.46 %
Bursts out of Tolerance
Phase Error GMSK
8PSK
Channel
Frequency
Frequency Offset
Expected Power
Mode
Attenuation
Decode
Trigger Source
Trigger Level
Display Mode
Statistic Count
Analyzer Generator
Power
Modulation
Spectrum

Fig. 4-12 Measurement menu Modulation – Phase Err. GMSK

Test Settings

The *Application, Frequency, Input Power,* and *Trigger/Statistics* test settings are identical with those in menu *Power* (see section *Test settings* on page 4.7). The following softkeys and hotkeys differ from the *Power* measurement:

Phase Err. GMSK

The *Phase Err. GMSK* softkey controls the GMSK modulation measurement and indicates its status *(RUN | HLT | OFF).*

This status can be changed after softkey selection (pressing once) by means of the *ON/OFF* key or the *CONT/HALT* key. The status of the measurement is unaffected upon switchover to other menus controlling a *Modulation* measurement, however, a running measurement is restarted.

Remote control

```
INITiate:MODulation:PERRor:GMSK
ABORt:MODulation:PERRor:GMSK
STOP:MODulation:PERRor:GMSK
CONTINUE:MODulation:PERRor:GMSK
```

Measurement configuration

Pressing the *Phase Err. GMSK* softkey twice opens the popup menu *Modulation Configuration* (see page 4.33 ff).

Time

The *Time* softkey configures the calculation of the phase errors in particular time intervals of the bursts.

Decode

The *Decode* hotkey defines whether guard or tail bits are decoded or not.

See section Measurement Control (Spectrum Configuration – Control) on page 4.43 ff.

Remote control

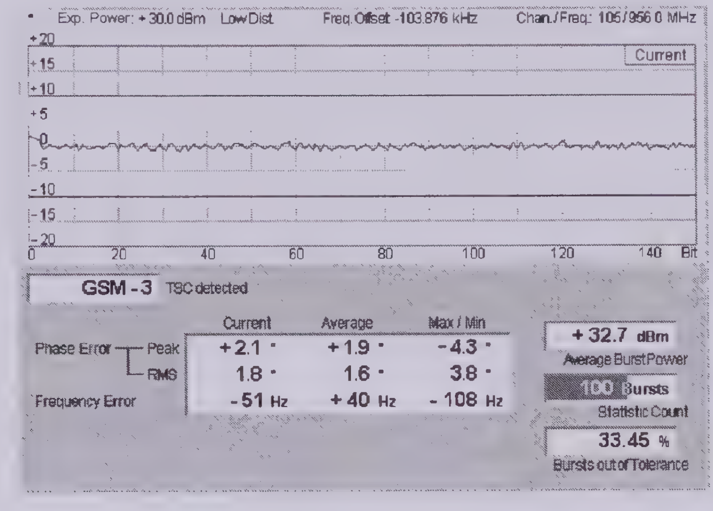
```
CONFigure:MODulation:PERRor:GMSK:TIME:DECode
  STANdard | GTBits
```

Measurement Results

The values shown in the measurement menu *Modulation* can be divided into three groups:

- Setting values
- Scalar measurement results (single values)
- Arrays (the phase error trajectory)

The values are indicated in a parameter line, the test diagram and a tabular overview below:



Parameter line

Test diagram

Output table

Exp. Power: +30.0 dBm LowDist Freq.Offset -103.876 kHz Chan./Freq: 105/956.0 MHz

GSM - 3 TSC detected

		Current	Average	Max / Min
Phase Error	Peak	+2.1 °	+1.9 °	-4.3 °
	RMS	1.8 °	1.6 °	3.8 °
Frequency Error		-51 Hz	+40 Hz	-108 Hz

+32.7 dBm
Average Burst Power

100 Bursts
Statistic Count

33.45 %
Bursts out of Tolerance

Fig. 4-13 Display of results (Modulation – Phase Err. GMSK)

Settings/ Scalar results Scalar measurement results and settings are indicated in the parameter line above the test diagram and in the output table below.

Parameter line The first parameter line contains the following settings:

Expected Power	Maximum input power set as in *Input Power – Expected Power* (see *Input Power (Group Configuration – Input Power)* on page 4.60)
Attenuation	Setting for the external attenuation of the input power *(Normal, Low Noise, Low Distortion)*
Freq. Offset	Frequency offset with respect to the nominal channel frequency
Chan./Freq.	RF channel and associated frequency

Remote control The settings are read out using the query corresponding to the setting command (setting command with appended question mark).

Output table The output table contains the following scalar values:

Average Burst P.	Average burst power, depending on the display mode set (see upper right corner of the diagram)
Statistic Count	Length of statistics cycle in bursts. The colored bar indicates the relative measurement progress in the statistics cycle
Bursts out of Tolerance	Percentage of bursts that violate the tolerance limits

The following scalar values are calculated for the current burst first. From the current results the average over a statistics cycle (*Average*) and the extreme value over all bursts measured so far *(Max/Min)* is calculated:

Phase Error (Peak)	Maximum phase error

	Phase Error (RMS)	Effective phase error (RMS-averaged over the burst)
	Frequency Error	Frequency error

Remote control

```
READ[:SCALar]:MODulation:PERRor:GMSK?
FETCh[:SCALar]:MODulation:PERRor:GMSK?
SAMPle[:SCALar]:MODulation:PERRor:GMSK?

CALCulate[:SCALar]:MODulation:PERRor:GMSK:MATChing:LIMit?
```

Measurement curves (arrays) The continuous measurement curve in the test diagram shows the phase error in the burst (in degrees) as a function of time (in bits). The display mode *(Current, Max./Min., Average)* for the measurement curve is indicated in the upper right corner of the diagram.

The scale of both axes is fixed. The measurement curve comprises the whole useful part of the normal burst (bit 0 to 146 ¾). The curve is derived from 588 equidistant measurement points with a ¼ bit spacing. The y-axis ranges from -20^0 to $+20^0$.

Due to the definition of the phase error (see shaded section on page 4.23), the phase error oscillates around the center of the diagram: The 0^0 line is equal to the regression line of the phase error trajectory calculated using the Mean Square Error method.

The two colored, horizontal lines in the test diagram mark the selected tolerance range of the phase error.

Remote control

```
READ:ARRay:MODulation:PERRor:GMSK...?
FETCh:ARRay:MODulation:PERRor:GMSK...?
SAMPle:ARRay:MODulation:PERRor:GMSK...?
```

Measurement Menu (Modulation – 8PSK)

If the 8PSK modulation scheme is selected (see *Application* softkey in section *Test Settings* on page 4.24 ff), the graphical measurement menu *Modulation* displays quantities characterizing the 8PSK modulation accuracy.

- The main softkey *Overview 8PSK* (which changes to *EVM 8PSK, Magn. Error 8PSK,* or *Phase Error 8PSK* if the corresponding application is selected) indicates the measurement status *(RUN | HLT | OFF)* and opens the configuration menu *Modulation Configuration* (press twice). The hotkeys associated to the main softkey define the scope of the *Modulation* measurement.
- The other softkeys to the right of the test diagram are combined with various hotkeys. The softkey/hotkey combinations provide test settings and switch over between different measurements. The entry of values is described in section *Measurement Menu (Power)* on page 4.6.

The measurement menu *Modulation* can be accessed from any other measurement menu of function group *GSMxxxx-BS Non Signalling* using the *Modulation* hotkey. It can be opened also from the *Menu Select* main menu (with the associated key at the front of the instrument).

Quantities characterizing the 8PSK modulation accuracy are determined as follows:

The actual modulation vector of the received signal from the base station is measured over the complete burst and stored. From a comparison of this measured modulation vector with the (computed) ideal signal vector, three non-redundant quantities are calculated (see Fig. 4-14):

Phase error	Difference in phase between the measured and the ideal signal vector.
Magnitude error	Difference between the magnitudes of the measured and the ideal signal vector.
Error vector magnitude	Magnitude of the vector connecting the measured and the ideal signal vector. In contrast to the previous quantities, the error vector magnitude cannot be negative.

These three quantities are calculated as a function of time and displayed over the whole useful part of the burst (symbol 6 to symbol 162), each of them in a separate graphical measurement menu. In addition, the peak and RMS values of all three quantities are calculated (over the whole display range or over the first ten symbols only) and displayed.

Finally, the *Modulation* measurement provides the following scalar quantities:

95th percentile	Limit value below which 95% of the values of a measurement curve are located. The 95th percentile of a measured quantity has the same unit as the quantity itself. In the 8PSK modulation measurement, the CMU determines 95th percentiles of the Error Vector Magnitude, the Magnitude Error, and the Phase Error.
Origin offset	Origin offset in the I/Q constellation diagram reflecting a DC offset in the baseband signal (see Fig. 4-15 on page 4.27 and Equation 4-1). The origin offset corresponds to an RF carrier feedthrough.
I/Q imbalance	Amplitude difference between the in-phase (I) to the quadrature (Q) components of the measured signal, normalized and logarithmized (see Fig. 4-15 on page 4.27 and Equation 4-2). The I/Q imbalance corresponds to an unwanted signal in the opposite sideband.
Frequency error	Difference of the measured frequency from the expected frequency.

For the **tolerance check** all three phase error curves can be fitted into a tolerance template and checked.

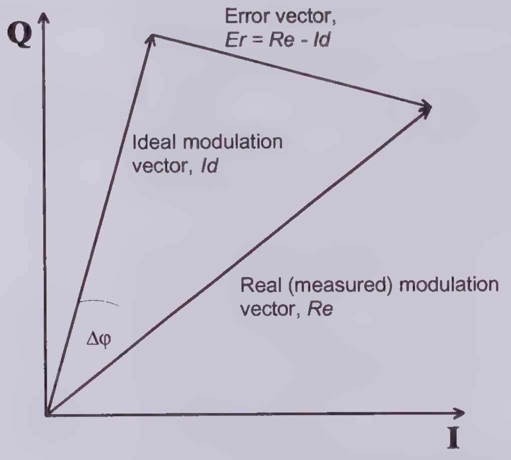

Q
Error vector,
Er = Re - Id
Ideal modulation vector, *Id*
Real (measured) modulation vector, *Re*
Δφ
I

Fig. 4-14 Modulation errors in the I/Q vector diagram

The I/Q vector diagram shows the following quantities measured in the *Modulation* menu:

$\lvert Er \rvert = \lvert Re - Id \rvert$	Error vector magnitude (EVM)
$\Delta\varphi$	Phase error
$\lvert Re \rvert - \lvert Id \rvert$	Magnitude error

The measurement diagrams show the relative magnitude error and the relative EVM, i.e. the quantities defined above divided by the magnitude of the ideal modulation vector | *Id* |.

Note: *The test functionality of the CMU is beyond the requirements of the standard where nothing regarding the phase error and magnitude error is specified.*

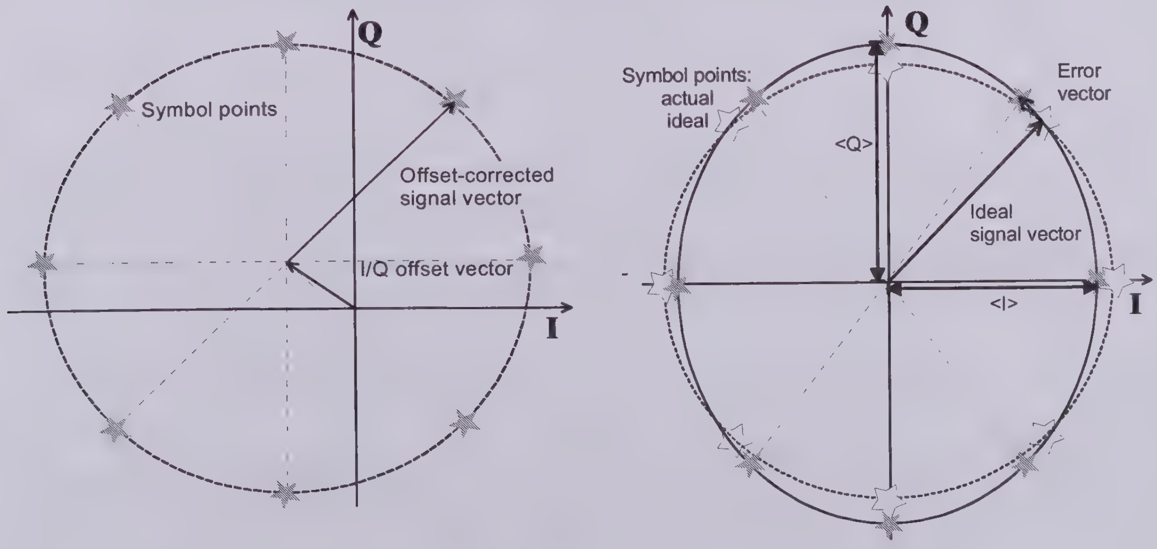


Fig. 4-15 Modulation errors in the I/Q constellation diagram

Fig. 4-15 is an idealized representation of the modulation errors where the effect of a pure origin offset (left diagram) and of a pure I/Q imbalance (right diagram) are completely disentangled. The I/Q offset in dB is the logarithmic ratio of the I/Q offset vector (i.e. the estimated DC-offset of the measured signal) to the average offset-corrected signal vector:

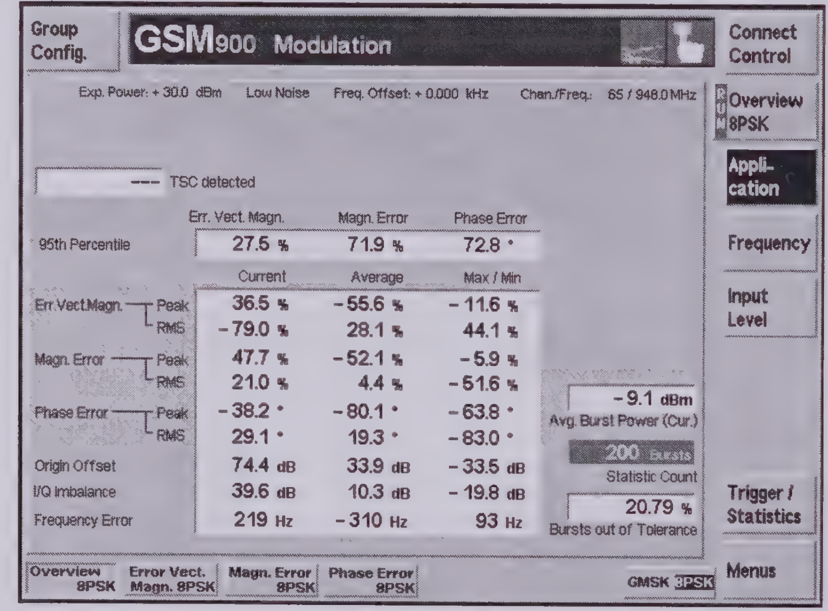
$$\text{Origin Offset} = 20\log\frac{|\text{I/Q offset vector}|}{|\text{Offset-corrected signal vector}|} \qquad \text{(Equation 4-1)}$$

In Equation 4-1, |Offset-corrected signal vector| denotes the magnitude of the offset-corrected signal vector averaged over all constellation points. The average is evaluated according to the prescription given in the annex of standard GSM 05.05.

The I/Q imbalance in dB is equal to the difference between the estimated I and Q amplitudes of the measured signals, which are normalized and logarithmized as follows:

$$\text{I/Q Imbalance} = 20\log\frac{|<I> - <Q>|}{|<I> + <Q>|} \qquad \text{(Equation 4-2)}$$

Appli-
cation
Overview
8PSK



Exp. Power: + 30.0 dBm Low Noise Freq. Offset: + 0.000 kHz Chan./Freq.: 65 / 948.0 MHz

--- TSC detected

	Err. Vect. Magn.	Magn. Error	Phase Error
95th Percentile	27.5 %	71.9 %	72.8 °

		Current	Average	Max / Min
Err.Vect.Magn.	Peak	36.5 %	-55.6 %	-11.6 %
	RMS	-79.0 %	28.1 %	44.1 %
Magn. Error	Peak	47.7 %	-52.1 %	-5.9 %
	RMS	21.0 %	4.4 %	-51.6 %
Phase Error	Peak	-38.2 °	-80.1 °	-63.8 °
	RMS	29.1 °	19.3 °	-83.0 °
Origin Offset		74.4 dB	33.9 dB	-33.5 dB
I/Q Imbalance		39.6 dB	10.3 dB	-19.8 dB
Frequency Error		219 Hz	-310 Hz	93 Hz

-9.1 dBm
Avg. Burst Power (Cur.)
200 Bursts
Statistic Count
20.79 %
Bursts out of Tolerance

Fig. 4-16 Measurement menu Modulation – Overview 8PSK

Test Settings

The *Frequency, Input Power,* and *Trigger/Statistics* test settings are identical with those in menu *Power* (see section *Test settings* on page 4.7). The *Overview 8PSK* main softkey (which changes to *EVM 8PSK, Magn. Error 8PSK,* or *Phase Error 8PSK* if the corresponding application is selected) is analogous to the *Phase Err. GMSK* softkey described in section *Test Settings* on page 4.24. With 8PSK modulation, the *Application* softkey provides the following applications:

Application

The *Application* softkey lets you change the measurement application and the modulation scheme.

Overview 8PSK

The *Overview 8PSK* hotkey selects all scalar modulation results to be displayed.

For an explanation of the measured quantities see explanation in section *Measurement Menu (Modulation – 8PSK)* on page 4.26.

Remote control

No explicit switchover command. All *Overview 8PSK* measurements are identified by the 3rd/4th level keywords `...OVERview:EPSK...`

EVM 8PSK

The *EVM 8PSK* hotkey selects the magnitude of the error vector to be displayed. The error vector connects the measured signal from the base station and the ideal signal vector at the symbol points, see explanation in section *Measurement Menu (Modulation – 8PSK)* on page 4.26. The diagram shows the relative magnitude (in percent), i.e. the ratio of the magnitude of the error vector to the magnitude of the ideal signal vector.

Remote control

No explicit switchover command. All *EVM 8PSK* measurements are identified by the 3rd/4th level keywords `...EVMagnitude:EPSK...`

Phase Error 8PSK

The *Phase Error 8PSK* hotkey selects the phase error of the modulation vector to be displayed. The phase error is the difference in phase between the measured signal from the base station and an ideal signal waveform at the symbol points, see explanation in section *Measurement Menu (Modulation – 8PSK)* on page 4.26.

Remote control

No explicit switchover command. All *Phase Error 8PSK* measurements are identified by the 3rd/4th level keywords `...PERRor:EPSK...`

Magn. Error 8PSK

The *Magnitude Error 8PSK* hotkey selects the magnitude error of the modulation vector to be displayed. The magnitude error is the difference in magnitude between the measured signal from the base station and an ideal signal waveform at the symbol points, see explanation in section *Measurement Menu (Modulation – 8PSK)* on page 4.26. The diagram shows the relative magnitude error (in percent), i.e. the ratio of the absolute magnitude error to the magnitude of the ideal signal vector.

Remote control

No explicit switchover command. All *Magn. Error 8PSK* measurements are identified by the 3rd/4th level keywords `...MERRor:EPSK...`

GMSK 8PSK

The *GMSK 8PSK* softkey toggles between 8PSK modulation and GMSK modulation. The current modulation scheme is marked in inverse video (white typeface on a dark background). Selecting another modulation scheme also changes the *Modulation* measurement menu; see section *Measurement Menu (Modulation – GMSK)* on page 4.23 ff.

Remote control

GMSK and 8PSK modulation is selected by the keywords `:GMSK` and `:EPSK` in the command headers, respectively.

Measurement Results

The values shown in the *Modulation* measurement menus can be divided into three groups:

- Setting values
- Scalar measurement results (single values)
- Arrays (traces plotted as a function of time)

The measurement menu for the *Overview* application shows all scalar results but no trace. The measurement menus for the remaining three applications are analogous and show the phase error, the (relative) magnitude error or the (relative) error vector magnitude as a function of time and the corresponding peak and effective values. The range and unit of the y-axis is adjusted to the measured quantity.

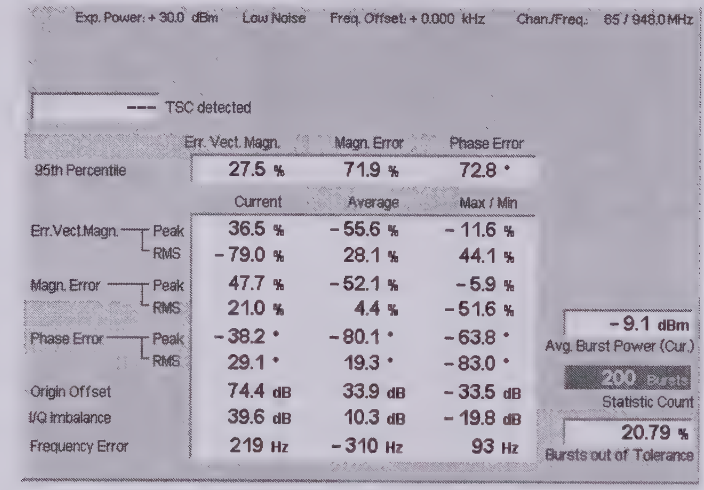
a) Scalar Results (Overview)

The measurement menu for the application *Overview 8PSK* shows all scalar results. Most of the values are indicated in tabular form:

Parameter line

Output fields

Output table
and additional fields



Exp. Power: + 30.0 dBm Low Noise Freq. Offset: + 0.000 kHz Chan./Freq.: 65 / 948.0 MHz

--- TSC detected

	Err. Vect. Magn.	Magn. Error	Phase Error
95th Percentile	27.5 %	71.9 %	72.8 °

		Current	Average	Max / Min
Err.Vect.Magn.	Peak	36.5 %	- 55.6 %	- 11.6 %
	RMS	- 79.0 %	28.1 %	44.1 %
Magn. Error	Peak	47.7 %	- 52.1 %	- 5.9 %
	RMS	21.0 %	4.4 %	- 51.6 %
Phase Error	Peak	- 38.2 °	- 80.1 °	- 63.8 °
	RMS	29.1 °	19.3 °	- 83.0 °
Origin Offset		74.4 dB	33.9 dB	- 33.5 dB
I/Q Imbalance		39.6 dB	10.3 dB	- 19.8 dB
Frequency Error		219 Hz	- 310 Hz	93 Hz

Avg. Burst Power (Cur.): - 9.1 dBm

Statistic Count: 200 Bursts

Bursts out of Tolerance: 20.79 %

Fig. 4-17 Display of results (Modulation – Overview)

Parameter line The parameter line contains the following settings:

Exp. Power	Maximum expected input power set as in *Input Power – Expected Power* (see section *Input Power (Group Configuration – Input Power)* on page 4.60),
Attenuation	Setting for the external attenuation of the input power *(Normal, Low Noise, Low Distortion)*,
Freq. Offset	Frequency offset with respect to the nominal channel frequency,
Chan./Freq.	RF channel and associated frequency.

Remote control The settings are read out using the query corresponding to the setting command (setting command with appended question mark).

Output fields In the output fields in the center of the menu, the following results are displayed:

TSC detected	Detected training sequence of the current burst received from the base station *(GSM 0 to 7* or *Dummy* or *"---")*, see section *Panel Analyzer Settings* on page 4.50.
95th percentile	Limit values below which 95% of the measured *Error Vector Magnitudes, Magnitude Errors,* and *Phase Errors* in the current burst are located. Owing to this definition, the 95th percentile of a measured quantity has the same unit as the quantity itself.

Output table The scalar values in the output table are explained at the beginning of this section on page 4.26. They are first calculated for the current burst. From the current results the average referenced to a statistics cycle (*Average,* see averaging prescription in Chapter 3, section *General Settings)* and the extreme value over all bursts measured during the ongoing measurement *(Max/Min)* is calculated. Peak and RMS[1] values are taken over the whole useful part of the burst.

Error Vect. Magn.	Peak and effective (RMS averaged) value of the relative error vector magnitude

---

[1] To keep the results comparable, RMS averaging was chosen for both positive quantities and quantities with alternating sign. The RMS-averaged EVM is calculated according to the prescription of GSM 05.05.

Magn. Error	Peak and RMS (relative) magnitude error
Phase Error	Peak and RMS phase error
Origin Offset	Origin offset in the I/Q constellation diagram
I/Q Imbalance	Amplitude difference between the I and Q components of the measured signal
Frequency Error	Difference between measured and expected signal frequency

Additional fields Three output fields to the right of output table indicate the following results and settings:

Avg. Burst Power	Average burst power, depending on the display mode set (see upper right corner of the diagram).
Statistic Count	Length of statistics cycle in bursts. The colored bar indicates the relative measurement progress in the statistics cycle,
Bursts out of Tolerance	Percentage of bursts that violate the tolerance limits.

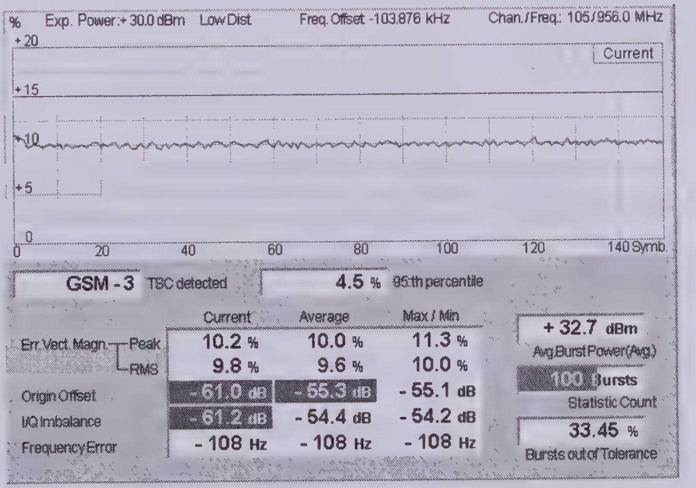
Limit Check A red output field and an arrow pointing upwards or downwards indicates that the measurement result exceeds the upper or lower limit set in the *Limits* tab of the *Modulation* configuration menu, see p. 4.34.

Remote control

```
READ[:SCALar]:MODulation:OVERview:EPSK? etc.
CALCulate[:SCALar]:MODulation:OVERview:EPSK:
  MATChing:LIMit?
```

b) Test Diagrams (EVM, Phase Error, Magn. Error)

The graphical measurement menus for the three applications *EVM 8PSK*, *Magn. Error 8PSK*, and *Phase Error 8PSK* are analogous. The results are indicated in a parameter line, the test diagram, and a tabular overview below:



% Exp. Power:+30.0 dBm Low Dist Freq. Offset -103.876 kHz Chan./Freq.: 105/956.0 MHz

GSM - 3 TSC detected

4.5 % 95th percentile

		Current	Average	Max / Min
Err. Vect. Magn.	Peak	10.2 %	10.0 %	11.3 %
	RMS	9.8 %	9.6 %	10.0 %
Origin Offset		- 61.0 dB	- 55.3 dB	- 55.1 dB
I/Q Imbalance		- 61.2 dB	- 54.4 dB	- 54.2 dB
Frequency Error		- 108 Hz	- 108 Hz	- 108 Hz

+ 32.7 dBm Avg.Burst Power(Avg.)

100 Bursts Statistic Count

33.45 % Bursts out of Tolerance

Fig. 4-18 Display of results (Modulation – EVM / Phase Error / Magn. Error)

Settings/ Scalar results Scalar measurement results and settings are indicated in the two parameter lines above the test diagram and in the output table below.

Parameter line

The first parameter line contains the following settings:

Exp. Power	Maximum input power set as in Input Power - Mode (see section Input Power (Group Configuration – Input Power) on page 4.60),
Attenuation	Setting for the external attenuation of the input power *(Normal, Low Noise, Low Distortion)*,
Freq. Offset	Frequency offset with respect to the nominal channel frequency,
Chan./Freq.	RF channel and associated frequency.

Remote control

The settings are read out using the query corresponding to the setting command (setting command with appended question mark).

Output fields

Below the diagram, the following results are displayed:

TSC detected	Detected training sequence of the current burst received from the base station *(GSM 0 to 7* or *Dummy* or *"---")*, see section *Panel Analyzer Settings* on page 4.50.
95th percentile	Limit values below which 95% of the measured *Error Vector Magnitudes, Magnitude Errors,* and *Phase Errors* in the current burst are located. Owing to this definition, the 95th percentile of a measured quantity has the same unit as the quantity itself.

Output table

The output table contains the following scalar values that:

Avg. Burst Power	Average burst power, depending on the display mode set (see upper right corner of the diagram)
Statistic Count	Length of statistics cycle in bursts. The colored bar indicates the relative measurement progress in the statistics cycle
Bursts out of Tolerance	Percentage of bursts that violate the tolerance limits

The following scalar values are calculated for the current burst first. From the current results the average referenced to a statistics cycle (*Average,* see averaging prescription in Chapter 3, section *General Settings)* and the extreme value over all bursts measured so far *(Max/Min)* is calculated:

Err. Vect. Magn. (Peak)	Maximum EVM (application *EVM 8PSK* only)
Err. Vect. Magn. (RMS)	Effective EVM (RMS-averaged over the burst)
Magn. Error (Peak)	Maximum magnitude error (application *Magn. Err. 8PSK*)
Magn. Error (RMS)	Effective magnitude error (RMS-averaged over the burst)
Phase Error (Peak)	Maximum phase error (application *Phase Err. 8PSK* only)
Phase Error (RMS)	Effective phase error (RMS-averaged over the burst)
Origin Offset	Origin offset in the I/Q constellation diagram
I/Q Imbalance	Amplitude difference between the I and Q components of the measured signal
Frequency Error	Difference between measured and expected signal frequency

Peak and RMS values are specific to the current application *(Phase Error, Magnitude Error* or *Error Vector Magnitude)*. For an explanation of all quantities measured refer to the beginning of this section on page 4.26.

Limit Check

A red output field and an arrow pointing upwards or downwards indicates that the measurement result exceeds the upper or lower limit set in the *Limits* tab of the *Modulation Configuration* menu, see p. 4.34.

Remote control `READ[:SCALar]:MODulation:EVMagnitude:EPSK?` etc.
`CALCulate[:SCALar]:MODulation:EVMagnitude:EPSK :MATChing:LIMit?`

Traces (arrays) The continuous trace in the test diagram shows the measured quantity as a function of time (in symbols). The display mode *(Current, Max./Min., Average)* for the trace is indicated in the upper right corner of the diagram.

The measurement curve comprises the whole useful part of the normal burst (bit 3 to 144). The curve is derived from 142 equidistant measurement points with a 1 bit spacing. The y-axis range is fixed for any of the three measured quantities (applications):

–20 deg to +20 deg	for the phase error
–20 % to +20 %	for the magnitude error
0 % to +20 %	for the error vector magnitude

Remote control `READ:ARRay:MODulation:EVMagnitude:EPSK:CURRent?` etc.

Measurement Configurations (Modulation Configuration)

The popup menu *Modulation Configuration* contains three tabs which determine the parameters of the phase and frequency error measurement including the error tolerances.

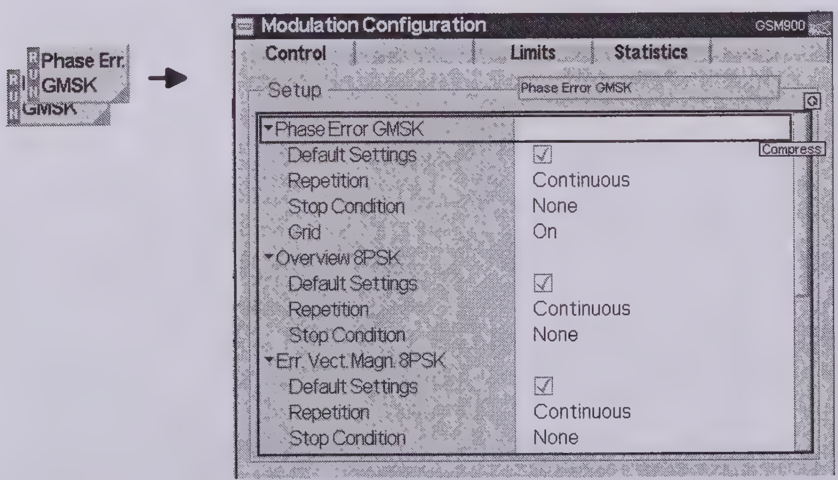
The popup menu *Modulation Configuration* is activated by pressing the softkey *Phase Err. GMSK* (or *Overview 8PSK* etc. if one of the other applications is selected) in the top right of the graphical measurement menu *Modulation* twice. By pressing the associated hotkeys, it is possible to change between the tabs.

Measurement Control (Modulation Configuration – Control)

The tab *Control* controls the phase and frequency error measurement by defining

- the *Repetition* mode,
- the *Stop Condition* for the measurement.

Besides, it influences the measurement diagram by adding a *Grid* or not.



Setup Phase Error GMSK

- Phase Error GMSK
  - Default Settings ☑
  - Repetition Continuous
  - Stop Condition None
  - Grid On
- Overview 8PSK
  - Default Settings ☑
  - Repetition Continuous
  - Stop Condition None
- Err. Vect. Magn. 8PSK
  - Default Settings ☑
  - Repetition Continuous
  - Stop Condition None

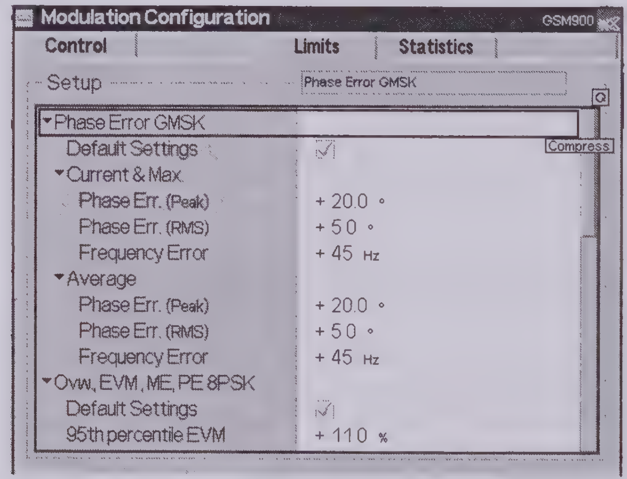
Fig. 4-19 Modulation Configuration – Control

The functions of this menu comply with those of the menu *Control* in the menu group *Power* (see page 4.15). In the remote-control commands, the keyword `POWer...` is to be replaced by `MODulation....`

Tolerance Values (Modulation Configuration – Limits)

The tab *Limits* defines upper and lower error limits for the measured values of the phase and frequency error measurement.

Phase Err.
GMSK
GMSK



Setup: Phase Error GMSK

▾Phase Error GMSK	
Default Settings	☑
▾Current & Max.	
Phase Err. (Peak)	+ 20.0 °
Phase Err. (RMS)	+ 5.0 °
Frequency Error	+ 45 Hz
▾Average	
Phase Err. (Peak)	+ 20.0 °
Phase Err. (RMS)	+ 5.0 °
Frequency Error	+ 45 Hz
▾Ovw, EVM, ME, PE 8PSK	
Default Settings	☑
95th percentile EVM	+ 11.0 %

Fig. 4-20 Modulation Configuration – Limits

Default Settings The *Default Settings* switches assign default values to all parameters of a particular application. The default values are quoted in the command description in chapter 6 of this manual.

Remote control `DEFault:MODulation:PERRor:GMSK:CONTrol ON | OFF etc.`

Phase Error GMSK The table section *Phase Error GMSK* defines upper limits for the different GMSK modulation parameters. The limits depend on the display mode of the measurement curve:

Default Settings	Overwrites all *GMSK settings* with their default values (see command description in Chapter 6)
Current & Max.	Common limits for the *Current* measurement curve and for the *Minimum/Maximum* curve
Average	Limits for the *Average* measurement curve

For setting of the display mode see section *Statistics Cycles (Modulation Configuration – Statistics)* on page 4.36.

The meaning of the error limits is the same for single-shot (Current & Max.) and average measurement:

Phase Err. Peak	Maximum phase error
Phase Err. RMS	RMS phase error (RMS-averaged over the burst)
Frequency Error	Average frequency error in the burst

The *Phase Error Peak* and the *Frequency Error* are quantities with alternating sign; the corresponding limits are symmetric to the origin (i.e. the absolute value of both quantities must fall below the specified positive limit). In contrast to the *Power* measurement where individual limit lines can be switched off, the *Modulation* limit check is always active.

Remote control

```
CONFigure:MODulation:PERRor:GMSK:CMMax:LIMit[:SCALar]
      :SYMMetric[:COMBined]:VALue
          <PhaseErrorPeak>,<PhaseErrorRMS>,<FrequencyError>

CCONFigure:MODulation:PERRor:GMSK:AVERage:LIMit[:SCALar]
      :SYMMetric[:COMBined]:VALue
          <PhaseErrorPeak>,<PhaseErrorRMS>,<FrequencyError>
```

Ovw., EVM, ME, PE 8PSK

The *Ovw., EVM, ME, PE 8PSK* table section defines all limits for 8PSK-modulated signals. The limits are set independently for the display modes *Current* and *Max./Min.* on one hand, *Average* on the other hand; see section *Statistics Cycles (Modulation Configuration – Statistics)* on page 4.36 ff.

Default Settings	Overwrites all *8PSK settings* with their default values (see command description in Chapter 6)
95th percentile PE	Upper limit for the phase error below which 95% of all measured phase error values are located
95th percentile ME	Upper limit for the magnitude error below which 95% of all measured relative magnitude error values are located
95th percentile EVM	Upper limit for the relative error vector magnitude below which 95% of all measured EVM values are located
Error Vector Magn.	Upper limits for the (peak and RMS-averaged[2]) relative error vector magnitude (EVM). Both entries are positive.
Magnitude Error	Upper limits for the absolute value of the (peak and RMS) relative magnitude error. Both entries are positive; the limits for the peak magnitude error define a tolerance mask symmetric to the origin.
Phase Error	Upper limits for the absolute value of the (peak and RMS) phase error. Both entries are positive; the limits for the peak phase error define a tolerance mask symmetric to the origin.
Origin Offset	Upper limit for the origin offset in the I/Q constellation diagram.
I/Q Imbalance	Upper limit for the amplitude difference between the in-phase and quadrature components of the signal.
Frequency Error	Upper limit for the difference between the measured and the expected frequency of the signal.

For an explanation of all measured quantities refer to the beginning of this section on page 4.26.

Remote control

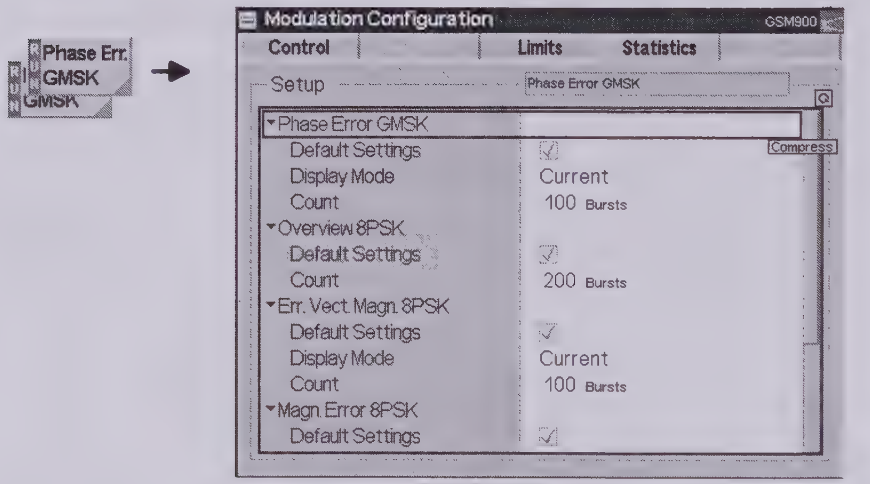
```
CONFigure:MODulation:OEMP:EPSK:CMMAX:LIMit[:SCALar]:
        SYMMetric[:COMBined]:VALue
CONFigure:MODulation:OEMP:EPSK:AVERage:LIMit[:SCALar]:
        SYMMetric[:COMBined]:VALue
CONFigure:MODulation:OEMP:EPSK:P95Th:LIMit[:SCALar]:
        SYMMetric[:COMBined]:VALue
```

---

[2] To keep the results comparable, RMS averaging was chosen for both positive quantities and quantities with alternating sign. The RMS-averaged EVM is calculated according to the prescription of GSM 05.05.

Statistics Cycles (Modulation Configuration – Statistics)

The tab *Statistics* defines the number of bursts per statistics cycle and the displayed trace *(Display Mode)*.



- Phase Error GMSK
  - Default Settings ☑
  - Display Mode Current
  - Count 100 Bursts
- Overview 8PSK
  - Default Settings ☑
  - Count 200 Bursts
- Err. Vect. Magn. 8PSK
  - Default Settings ☑
  - Display Mode Current
  - Count 100 Bursts
- Magn. Error 8PSK
  - Default Settings ☑

Fig. 4-21 Modulation Configuration – Statistics

Default Settings	The *Default Settings* switches assign default values to all parameters of a particular application. The default values are quoted in the command description in chapter 6 of this manual.
Remote control	`DEFault:MODulation:PERRor:GMSK:CONTrol ON	OFF` etc.

Display Mode The *Display Mode* field defines which of the measured and calculated traces is displayed. The traces differ in the way the phase error $\Delta(t)$ at a fixed point in time t is calculated if the measurement extends over several bursts:

Current	Measured value for the current burst
Max./Min.	Extreme value over a number of bursts
Average	Average value over a number of bursts

The number of bursts for the calculation of the statistic values *Minimum/Maximum* and *Average* – and thus the result – depends on the set measurement mode (see section *Measurement Control (Power Configuration* – Control) on page 4.15). In detail, this implies:

Single shot	Display of minimum, maximum and average value from the performed statistics cycle
Continuous	Display of minimum and maximum from all bursts already measured. The **average value**, however, is calculated according to the averaging prescription in Chapter 3, section *General Settings*.

In a power measurement, absolute values are determined, whereas the measured phase error can have both positive or negative sign. To assess the phase error only the magnitude (and not the sign) is relevant so that the *Modulation* menu shows extreme values instead of maxima and minima.

Remote control No display mode set, the three traces are accessible via

```
FETCh:ARRAy:MODulation:PERRor:GMSK:CURRent?
FETCh:ARRAy:MODulation:PERRor:GMSK:MMAXimum?
FETCh:ARRAy:MODulation:PERRor:GMSK:AVERage? etc.
```

Statistic Count	The input field *Statistic Count* defines the length of the statistics cycles in bursts/evaluation periods. *1 to 1000 Bursts* Number of bursts per statistics cycle A statistics cycle is equal to the duration of a single shot (see section *Measurement Control (Power Configuration* – Control) on page 4.15).
Remote control	`CONFigure:MODulation:CONTrol <MODE>,1 ... 1000 | NONE`

Spectrum Measurements

The menu group *Spectrum* comprises the functions for measurement of the off-carrier power originating from the modulation process *(spectrum due to modulation)* and from the bursty nature of the RF signal, i.e. the power ramping up and down *(spectrum due to switching)*. The two spectra are treated as two different applications; they are displayed in two separate graphical measurement menus *Spectrum* (applications *Due to Modulation* and *Due to Switching),* the popup menu *Spectrum Configuration* is used for configuration of the measurements.

The *Spectrum* measurement serves to measure the amount of energy that spills outside the designated radio channel when the base station transmits at variable output power. The measurement is performed in the time domain (zero frequency span mode), at a series of frequency points symmetrically distributed around the nominal frequency of the designated channel (see section *Tolerance Values (Spectrum Configuration – Limit* Lines) on page 4.44 ff).

In GSM 05.05 and GSM 11.21, the two *Spectrum* measurements are specified in detail:

- For the *spectrum due to modulation*, the power must be averaged over 50% to 90% of the useful part of the burst, excluding the training sequence, and then averaged again over a given minimum number of bursts.
- For the *spectrum due to switching*, the peak power over a minimum number of bursts must be determined.

Additional requirements concerning the measurement bandwidths are specified.

The *Spectrum* measurements for GMSK and 8PSK modulation are analogous, however, the tolerance values specified in the GSM standard vary depending on the modulation scheme.

Measurement Menu (Spectrum)

The graphical measurement menu *Spectrum* displays the results of the adjacent channel power measurement.

- The main softkey *Modulation GMSK* (which changes to *Switching GMSK, Modulation 8PSK,* or *Switching 8PSK* when the corresponding application or modulation scheme is selected) controls the measurement, indicates its status *(RUN | HLT | OFF)* and opens the configuration menu *Spectrum Configuration.* The hotkeys associated to the main softkey define the scope of the *Spectrum* measurement.
- The softkeys *Application, Frequency, Input Power, Marker, Trigger/Statistics and Menus* to the right of the test diagram are combined with various hotkeys. When a softkey is selected and an associated hotkey pressed, a popup window appears which indicates a setting or enables an entry (see section *Measurement Menu (Power)* on page 4.6).

The measurement menu *Modulation* can be accessed from any other measurement menu of function group *GSMxxxx-BS Non Signalling* using the *Spectrum* hotkey. It can be opened also from the *Menu Select* main menu (with the associated key at the front of the instrument).

Menu Select

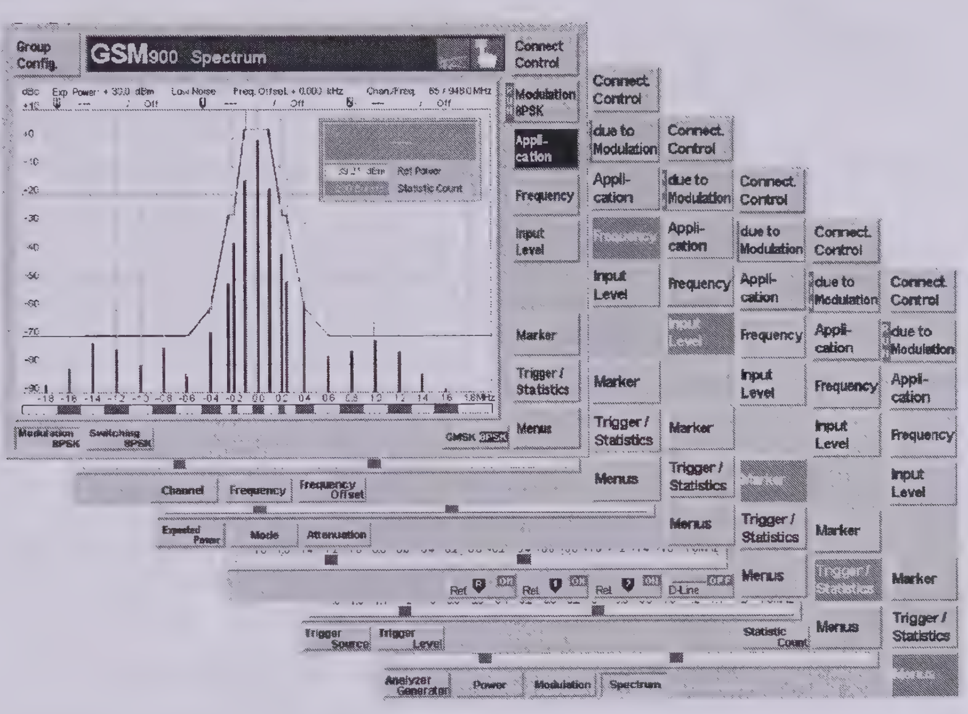

Group Config.
GSM900 Spectrum
Connect Control
Modulation 8PSK
Appli-cation
Frequency
Input Level
Marker
Trigger / Statistics
Menus
due to Modulation
Modulation 8PSK
Switching 8PSK
GMSK 8PSK
Channel
Frequency
Frequency Offset
Expected Power
Mode
Attenuation
Ref.
D-Line
Trigger Source
Trigger Level
Statistic Count
Analyzer Generator
Power
Modulation
Spectrum

Fig. 4-22 Measurement menu Spectrum due to Modulation

Test Settings

The *Frequency, Input Power, Marker, Trigger/Statistics,* and *Menu* settings are identical with those in the *Power* menu (see section *Test Settings* on page 4.7; no display mode can be set in the *Spectrum* menu). The *Spectrum* measurement differs from the *Power* measurement in the *Application* softkey.

Modulation GMSK

The *Modulation GMSK* softkey controls the measurement and indicates its status *(RUN | HLT | OFF).*

This status can be changed after softkey selection (pressing once) by means of the *ON/OFF* key or the *CONT/HALT* key. The status of the measurement is unaffected upon switchover to other menus controlling a *Spectrum* measurement, however, a running measurement is restarted.

Remote control

```
INITiate:SPECtrum:MODulation:GMSK
ABORt:SPECtrum:MODulation:GMSK
STOP:SPECtrum:MODulation:GMSK
CONTINUE:SPECtrum:MODulation:GMSK
```

Measurement configuration

Pressing the *Modulation GMSK* softkey twice opens the popup menu *Spectrum Configuration* (see page 4.33 ff).

Appli-cation

The *Application* softkey lets you change the type of spectrum to be measured and the modulation scheme.

The two alternative spectra (applications) are displayed in separate measurement menus. When an application is selected, the corresponding measurement menu is called up and the labeling of the main softkey controlling the measurement is adapted. The configuration settings for both applications, however, are listed in a common popup menu (see p. 4.33 ff).

Modulation GMSK

The *Modulation GMSK* hotkey selects the spectrum due to modulation to be displayed. In this mode, the power at the nominal frequency and the relative power at up to 11 neighboring frequencies is displayed in a single graph, see p. 4.40 ff.

Remote control

No explicit switchover command. All spectrum due to modulation measurements are identified by the 2nd to 4th level keywords `..SPECtrum:MODulation:GMSK`

Switching GMSK

The *Switching GMSK* hotkey selects the spectrum due to switching to be displayed. In this mode, the power at the nominal frequency and the relative power at up to 4 neighboring frequencies is displayed in a single graph, see p. 4.42 ff.

Remote control

No explicit switchover command. All spectrum due to modulation measurements are identified by the 2nd to 4th level keywords `...SPECtrum:SWITching:GMSK`

GMSK 8PSK

The *GMSK 8PSK* hotkey toggles between GMSK modulation and 8PSK modulation (option CMU-K41 required). The currently selected modulation scheme is marked in inverse video (white typeface on a dark background). Selecting another modulation scheme also changes the main softkey and the application hotkeys in the *Spectrum* measurement menu.

Remote control

GMSK and 8PSK modulation is selected by the keywords `:GMSK` and `:EPSK` in the command headers, respectively.

Measurement Results

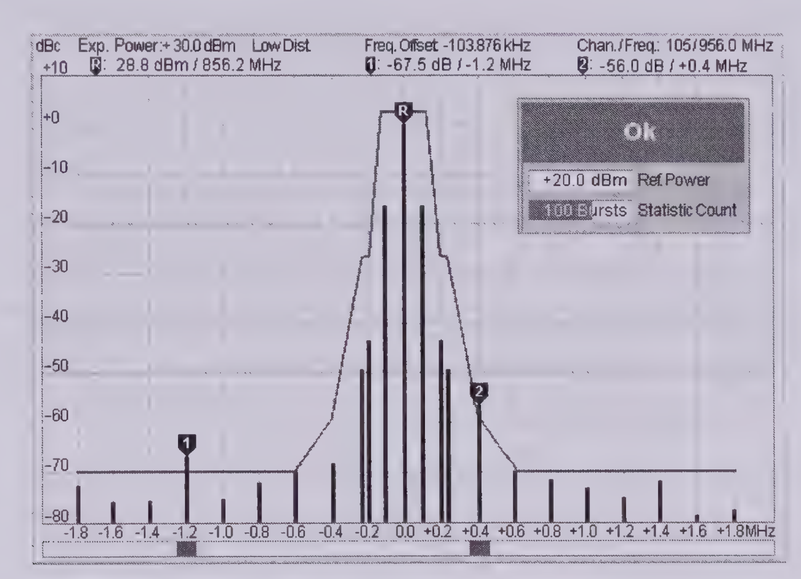
The *Spectrum* measurement menu and the results depend on the type of spectrum (application) selected. The scaling of both axes is equal for the two spectra.

a) Spectrum due to Modulation

In the *Spectrum due to Modulation* measurement, the average burst power at a series of fixed frequency points around the selected RF frequency is displayed. The results and the corresponding settings are indicated in two parameter lines, the test diagram (bar graph), and an info box:

Parameter lines

Bar graph and info box


dBc Exp. Power:+30.0 dBm LowDist Freq. Offset -103.876 kHz Chan./Freq.: 105/956.0 MHz

+10 R: 28.8 dBm / 856.2 MHz 1: -67.5 dB / -1.2 MHz 2: -56.0 dB / +0.4 MHz

Ok

+20.0 dBm Ref.Power

100 Bursts Statistic Count

+0
-10
-20
-30
-40
-50
-60
-70
-80
R
1
2
-1.8 -1.6 -1.4 -1.2 -1.0 -0.8 -0.6 -0.4 -0.2 0.0 +0.2 +0.4 +0.6 +0.8 +1.0 +1.2 +1.4 +1.6 +1.8MHz

Fig. 4-23 Display of results (spectrum due to modulation)

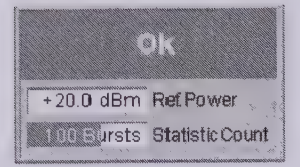
Parameter lines The first parameter line contains the following settings:

Expected Power	Maximum input power set as in *Input Power - Mode* (see section *Input Power (Group Configuration – Input Power)* on page 4.60)
Attenuation	Setting for the external attenuation of the input power *(Normal, Low Noise, Low Distortion)*
Freq. Offset	Frequency offset with respect to the nominal channel frequency
Chan./Freq.	RF channel and associated frequency

2nd parameter line The second parameter line contains the following marker values:

R	Absolute power (in dBm) and frequency offset from the carrier of reference marker
1	Power (in dBm) and frequency offset of delta marker 1 (setting *absolute*). With setting *relative,* the level difference from the carrier is indicated (same as the diagram units)
2	Power and time of delta marker 2, see delta marker 1

Info box


Ok

+20.0 dBm Ref.Power

100 Bursts Statistic Count

The info box indicates the following scalar results and settings:

Burst Matching	Error message if the displayed burst is out of tolerance.
Ref. Power	Absolute value of the measured carrier output power of the BTS. According to GSM specifications, the *Ref. Power* is measured with a filter bandwidth of 30 kHz so that it differs from the average burst power determined in the *Power* menu.
Statistic Count	Number of bursts per statistics cycle

Remote control The settings are read out using the query corresponding to the setting command (setting command with appended question mark). The reference power and burst matching are retrieved with a single command:

```
READ[:SCALar]:SPECtrum:MODulation:GMSK?
FETCh[:SCALar]:SPECtrum:MODulation:GMSK?
SAMPle[:SCALar]:SPECtrum:MODulation:GMSK?
```

Response: `<RefPower>,<Matching>`

Bar graph The bar graph shows the current carrier output power of the BTS and the measured spectrum due to modulation at 11 non-equidistant frequencies that are symmetrically distributed around the carrier frequency. The diagram is scaled such that the x-axis indicating the frequency offset from the carrier ranges from –2 MHz to +2 MHz; the carrier output power forms the 0 dB reference level. The spectral tolerance mask defined in the *Limit Lines* tab (see p. 4.44 ff) is indicated in addition. The measurement result at particular frequencies can be read out by means of markers. At every single frequency point, the measurement can be switched on or off in the *Meas X* tab (see p. 4.48).

Limit Check The upper limit lines defined in the Limit Lines tab of the configuration menu (see p. 4.44 ff) yield the red polygonal curve in the diagram. If the limit check fails at a particular test point the corresponding section of the bar across the bottom of the diagram turns red.

Remote control

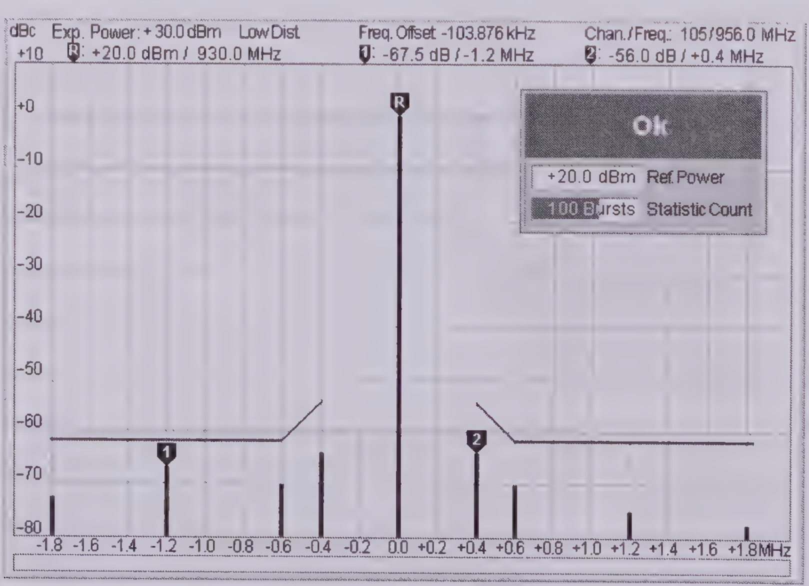
```
READ:ARRay:SPECtrum:MODulation:GMSK?
FETCh:ARRay:SPECtrum:MODulation:GMSK?
SAMPle:ARRay:SPECtrum:MODulation:GMSK?
```

b) Spectrum due to Switching

In the *Spectrum due to Switching* measurement, the maximum level at a series of fixed frequency points around the selected RF frequency is displayed. The results and the corresponding settings are indicated in two parameter lines, the test diagram (bar graph), and an info box:

Parameter lines

Bar graph and info box



dBc Exp. Power: +30.0 dBm LowDist Freq. Offset -103.876 kHz Chan./Freq.: 105/956.0 MHz

+10 R: +20.0 dBm / 930.0 MHz 1: -67.5 dB / -1.2 MHz 2: -56.0 dB / +0.4 MHz

Ok

+20.0 dBm Ref. Power

100 Bursts Statistic Count

R
1
2
+0
-10
-20
-30
-40
-50
-60
-70
-80
-1.8 -1.6 -1.4 -1.2 -1.0 -0.8 -0.6 -0.4 -0.2 0.0 +0.2 +0.4 +0.6 +0.8 +1.0 +1.2 +1.4 +1.6 +1.8MHz

Fig. 4-24 Display of results (spectrum due to switching)

The two parameter lines and the info box are identical with the *due to Modulation* menu, see above. Note that, according to GSM specifications, the Ref. Power is measured with a filter bandwidth of 300 kHz so that it slightly differs from the average burst power determined in the *Power* menu.

Bar graph The bar graph shows the current carrier output power of the BTS and the measured spectrum due to switching at 4 non-equidistant frequencies that are symmetrically distributed around the carrier frequency. The diagram is scaled such that the x-axis indicating the frequency offset from the carrier ranges from –2 MHz to +2 MHz; the carrier output power forms the 0 dB reference level. The spectral tolerance mask defined in the *Limit Lines* tab (see p. 4.44 ff) is indicated in addition. The measurement result at particular frequencies can be read out by means of markers. At every single frequency point, the measurement can be switched on or off in the *Meas X* tab (see p. 4.48).

Limit Check The upper limit lines defined in the Limit Lines tab of the configuration menu (see p. 4.44 ff) yield the red polygonal curve in the diagram. If the limit check fails at a particular test point the corresponding section of the bar across the bottom of the diagram turns red.

Remote control

```
READ:ARRay:SPECtrum:SWITching:GMSK?
FETCh:ARRay:SPECtrum:SWITching:GMSK?
SAMPle:ARRay:SPECtrum:SWITching:GMSK?
```

Measurement Configurations (Spectrum)

The popup menu *Spectrum Configuration* contains four tabs which define the parameters of the phase and frequency error measurement including the error tolerances.

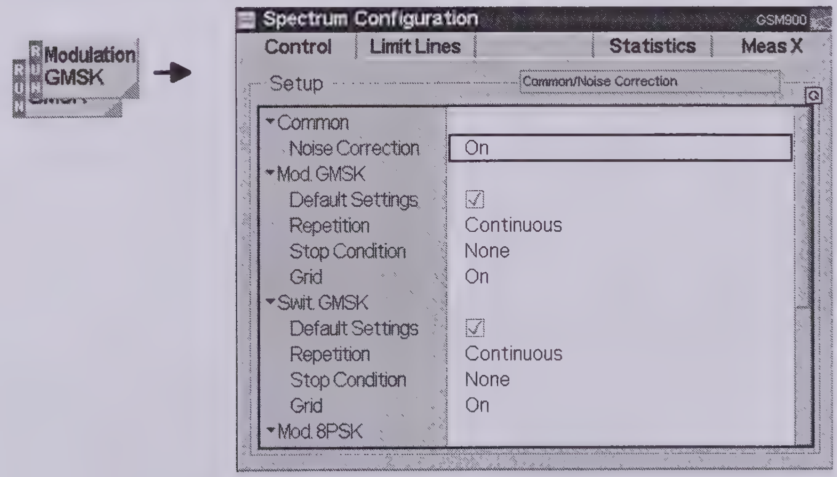
The popup menu *Spectrum Configuration* is called up by pressing the main softkey in the top right of the graphical measurement menu *Spectrum* twice (this softkey reads *Modulation GMSK/8PSK* or *Switching GMSK/8PSK*, depending on the selected application and modulation scheme). By pressing the associated hotkeys, it is possible to change between the tabs.

Measurement Control (Spectrum Configuration – Control)

The tab *Control* controls the spectrum measurement by defining

- The *Repetition* mode
- The *Stop Condition* for the measurement

Besides, it influences the measurement diagram by adding or removing the *Grid.*



Common
Noise Correction On
Mod. GMSK
Default Settings ☑
Repetition Continuous
Stop Condition None
Grid On
Swit. GMSK
Default Settings ☑
Repetition Continuous
Stop Condition None
Grid On
Mod. 8PSK

Fig. 4-25 Spectrum Configuration – Control

Noise Correction The *Noise Correction* field switches the noise corrections for all spectrum measurements on or off. The noise correction improves the dynamic range but slightly reduces the speed of the measurement.

Remote control `CONFigure:SPECtrum[:COMMon]:NOISe:CORRection ON | OFF`

All remaining settings can be defined separately for the two applications *due to Modulation* and *due to Switching* and for the two modulation schemes *GMSK* and *8PSK*. They comply with those of the menu *Control* in the menu group *Power* (see page 4.15). In the remote-control commands, the keyword `POWer` is to be replaced by `SPECtrum:MODulation` or `SPECtrum:SWITching`.

Tolerance Values (Spectrum Configuration – Limit Lines)

The tab *Limit Lines* defines upper limits for the output spectrum around the RF carrier frequency. All relative limit values are referred to the actual carrier output power of the base station.

a) Spectrum due to Modulation

The limit lines for the *spectrum due to modulation* as specified in standards GSM 05.05 and GSM 11.21 depend on both the frequency and (for frequencies that differ from the carrier frequency by more than 400 kHz) on the output power of the base station. The following values apply to all GSM bands:

Table 4-1 GSM tolerances for spectrum due to modulation

Frequency offset / [MHz]	**Relative power at a BTS output power ≤ 33 dBm (in dBc)**	**Relative power at a BTS output power ≥ 43 dBm (in dBc)**
0.1	+0.5	+0.5
0.2	–30	–30
0.25	–33	–33
0.4	–60 (GMSK modulation) –56 (8PSK modulation)	–60 (GMSK modulation) –56 (8PSK modulation)
0.6	–60	–70
1.2	–63	–73
<1.8	–63	–73

Between the frequency points in the table, the limits are determined by linear interpolation. Analogously, in the frequency range above 400 kHz from the carrier and for output powers between 33 dBm and 43 dBm, the limit depends linearly on the output power. The resulting spectral mask is shown below (Fig. 4-26).

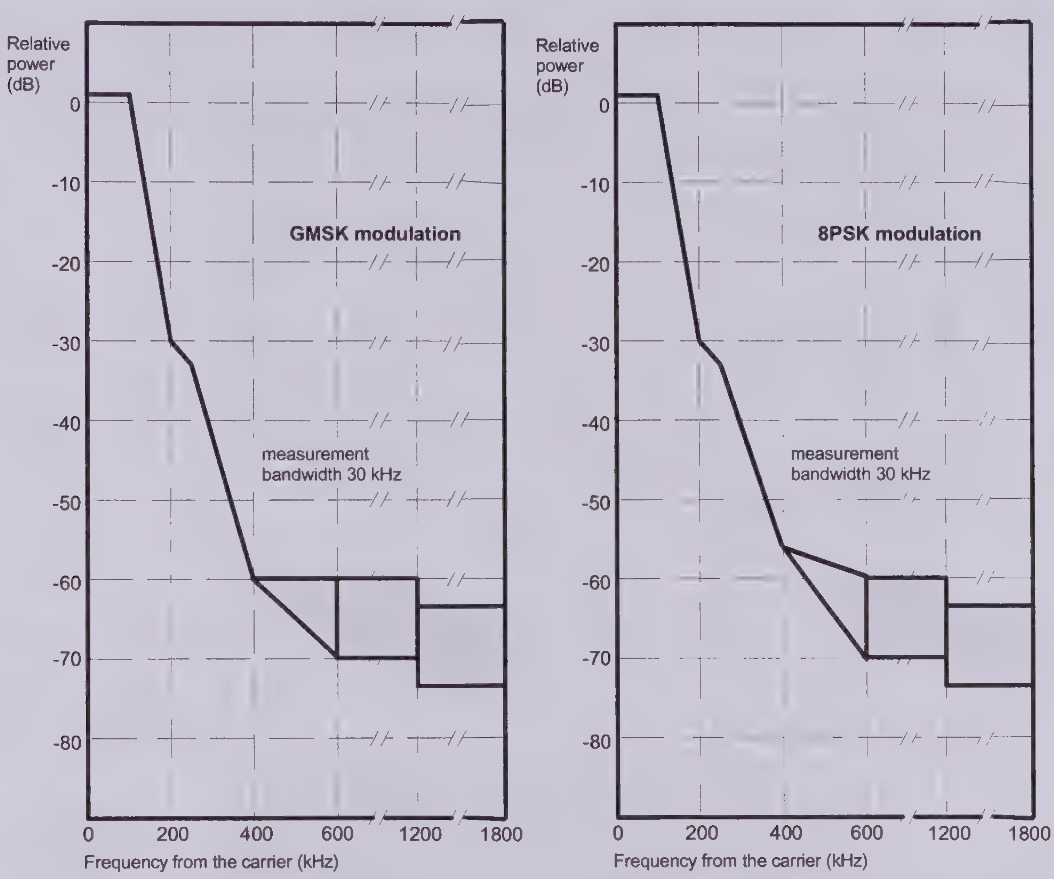
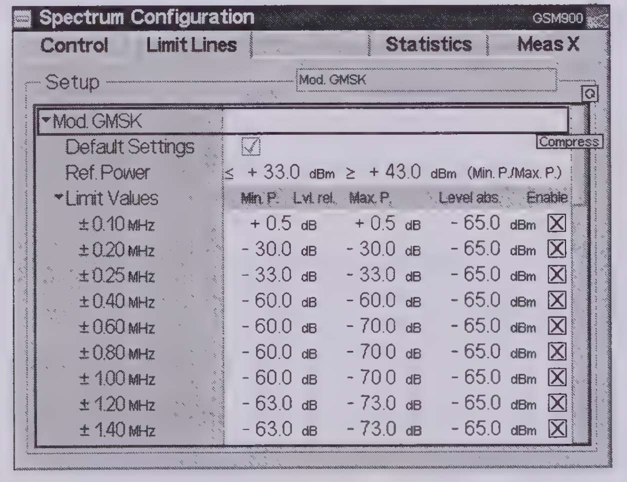


Fig. 4-26 Spectral mask as specified for GSM base stations

Slightly different limit lines are specified for micro and pico BTSs. Moreover, according to GSM 05.05 and 11.21, exceptions to the limit lines are allowed up to a level of –36 dBm and in a limited number of bands of limited width.

Modulation
GMSK



Mod. GMSK

▾Mod. GMSK

Default Settings ☑

Ref. Power ≤ + 33.0 dBm ≥ + 43.0 dBm (Min. P./Max. P.)

▾Limit Values	Min. P. Lvl. rel.	Max. P.	Level abs.	Enable
± 0.10 MHz	+ 0.5 dB	+ 0.5 dB	- 65.0 dBm	☒
± 0.20 MHz	- 30.0 dB	- 30.0 dB	- 65.0 dBm	☒
± 0.25 MHz	- 33.0 dB	- 33.0 dB	- 65.0 dBm	☒
± 0.40 MHz	- 60.0 dB	- 60.0 dB	- 65.0 dBm	☒
± 0.60 MHz	- 60.0 dB	- 70.0 dB	- 65.0 dBm	☒
± 0.80 MHz	- 60.0 dB	- 70.0 dB	- 65.0 dBm	☒
± 1.00 MHz	- 60.0 dB	- 70.0 dB	- 65.0 dBm	☒
± 1.20 MHz	- 63.0 dB	- 73.0 dB	- 65.0 dBm	☒
± 1.40 MHz	- 63.0 dB	- 73.0 dB	- 65.0 dBm	☒

Fig. 4-27 Spectrum Configuration – Limit Lines

Default Settings The *Default Settings* switches assign default values to all parameters of a particular application. The default values are quoted in the command description in chapter 6 of this manual.

Remote control `DEFault:SPECtrum:MODulation:GMSK:LIMit:LINE ON|OFF` etc.

Ref. Power The *Ref. Power* line indicates the BTS carrier output power domain (33 dBm to 43 dBm according to the GSM standard) where the limit lines are to be determined by linear interpolation. Below *Min. P.*, the lower limit line applies, above *Max. P.*, the upper limit line applies. The *Ref. Power* domain can be modified.

Remote control

```
CONFigure:SPECtrum:MODulation:GMSK:LIMit:LINE:SYMMetric
          [:COMBined]:RPOWer <Min_Power>,<Max_Power>
```

Limit Values The *Limit Values* table section defines upper limits for the power at eleven fixed, GSM-specific frequency offsets:

Lvl. rel.	Upper limit for the RF power referred to the actual BTS carrier output power, valid for output powers below the *Ref. Power* domain *(Min. P.)* and for output powers above the *Ref. Power* domain *(Max. P.)*. Inside the *Ref. Power* domain, *Lvl. rel.* is determined by linear interpolation.
Level abs.	Alternative absolute power limits, to be applied if the relative limits *Lvl. rel.* are tighter
Enable	Switches the limit check at the frequency on and off.

Remote control

```
CONFigure:SPECtrum:MODulation:GMSK:LIMit:LINE:SYMMetric
          [:COMBined]:FREQuency<nr>
            <Min_Rel>,<Max_Rel>,<Abs>,<Enable> etc.
CONFigure:SPECtrum:MODulation:GMSK:LIMit:LINE:SYMMetric
          [:COMBined]:ENABle ON | OFF  etc.
```

b) Spectrum due to Switching

The limit lines for the *spectrum due to switching* as specified in standard GSM 05.05 and 11.21 cover offset frequencies between 0.4 and 1.8 MHz and do not depend on the output power of the base station. Different limit lines are defined for the individual GSM bands:

Table 4-2 GSM tolerances for spectrum due to switching

Frequency offset / [MHz]	**Maximum power relative to carrier / [dBc]**	
	GSM 400/900	**GSM 1800 /1900**
0.4	–57 (GMSK modulation) –52 (8PSK modulation)	–50
0.6	–67 (GMSK modulation) –62 (8PSK modulation)	–58
1.2	–74	–66
1.8	–74	–66

The minimum absolute limit is –36 dBm for all frequencies and GSM bands.

Default Settings The *Default All Settings* switch assigns default values to all settings in the *Limits* tab (the default values are quoted in the command description in chapter 6 of this manual). In addition, default switches for the individual spectrum types are provided.

Remote control `DEFault:SPECtrum:SWITching:GMSK:LIMit:LINE ON|OFF` etc.

Limit Values The *Limit Values* table section defines upper limits for the power at four fixed, GSM-specific frequency offsets:

Lvl. rel. [dBc]	Upper limit for the RF power referred to the actual BTS carrier output power
Level abs.[dB]	Absolute limit for the RF power, to be applied if the relative limits *Lvl. rel.* are tighter
Enable	Switches the limit check at the frequency on and off

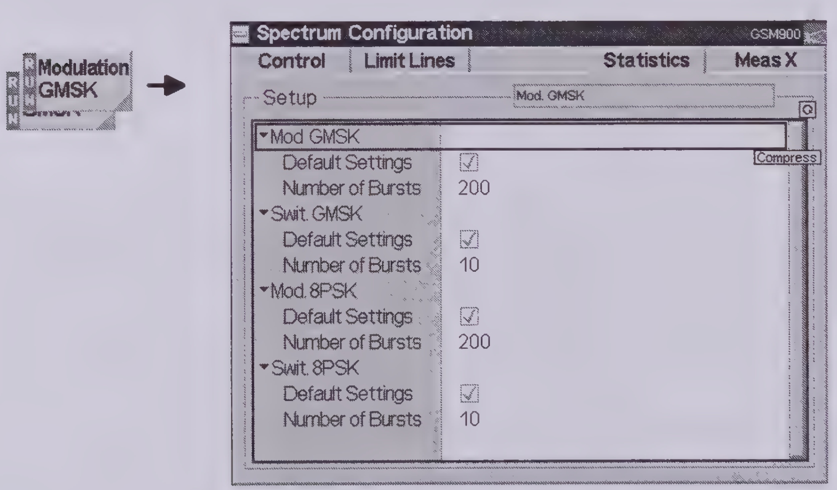
If both a relative and an absolute limit at a frequency is defined, the limit check corresponds to the looser criterion (the higher of the two values).

Remote control

```
CONFigure:SPECtrum:SWITching:GMSK:LIMit:LINE:SYMMetric
          [:COMBined]:FREQuency<nr>
            <Min_Rel>,<Max_Rel>,<Abs>,<Enable> etc.
CONFigure:SPECtrum:SWITching:GMSK:LIMit:LINE:SYMMetric
          [:COMBined]:ENABle ON | OFF   etc.
```

Statistics cycles (Modulation Configuration – Statistics)

The tab *Statistics* defines the number of bursts forming a statistics cycle and the displayed spectrum *(Display Mode)*.



Mod GMSK
Default Settings ☑
Number of Bursts 200
Swit. GMSK
Default Settings ☑
Number of Bursts 10
Mod. 8PSK
Default Settings ☑
Number of Bursts 200
Swit. 8PSK
Default Settings ☑
Number of Bursts 10

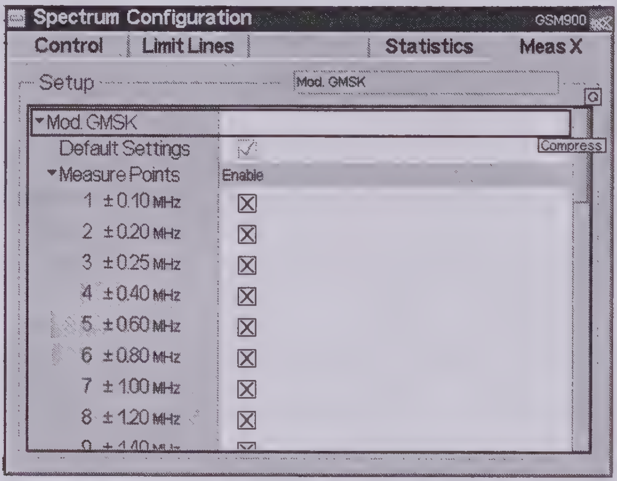
Fig. 4-28 Spectrum Configuration – Limits

All settings can be defined separately for the two applications *due to Modulation* and *due to Switching*. They comply with those of the menu *Statistics* in the menu group *Power* (see page 4.15). In the remote-control commands, the keyword `POWer` is to be replaced by `SPECtrum:MODulation` or `SPECtrum:SWITching`.

Selection of Measurement Points (Modulation Configuration – Meas X)

The tab *Meas X* defines at which frequencies a *Spectrum* measurement is performed.

Modulation
GMSK



Setup: Mod. GMSK

Mod. GMSK

Default Settings ✓

Measure Points	Enable
1 ±0.10 MHz	☒
2 ±0.20 MHz	☒
3 ±0.25 MHz	☒
4 ±0.40 MHz	☒
5 ±0.60 MHz	☒
6 ±0.80 MHz	☒
7 ±1.00 MHz	☒
8 ±1.20 MHz	☒

Fig. 4-29 Spectrum Configuration – Meas X

All settings can be defined separately for the two applications *due to Modulation* and *due to Switching*.

Default Settings The *Default Settings* switches assign default values to all parameters of a particular application. The default values are quoted in the command description in chapter 6 of this manual.

Remote control `DEFault:SPECtrum:MODulation:GMSK:CONTrol ON|OFF` etc.
`DEFault:SPECtrum:SWITching:GMSK:CONTrol ON|OFF` etc.

Measure Points The *Measure Points* table section enables (*Enable* box checked) or disables the spectrum measurement at individual frequency points. All frequencies listed in Table 4-1 (spectrum due to modulation) and Table 4-2 (spectrum due to switching) can be selected.

Remote control `CONFigure:SPECtrum:MODulation:GMSK:MPOint<nr>:ENABle ON|OFF`
`CONFigure:SPECtrum:SWITching:GMSK:MPOint<nr>:ENABle ON|OFF`
etc.

Connection Control

The popup menu *Connection Control* consists of three tabs which configure the inputs and outputs of the CMU and the respective signals in the function group *GSM400/900/1800/1900-BTS Non Signalling.*

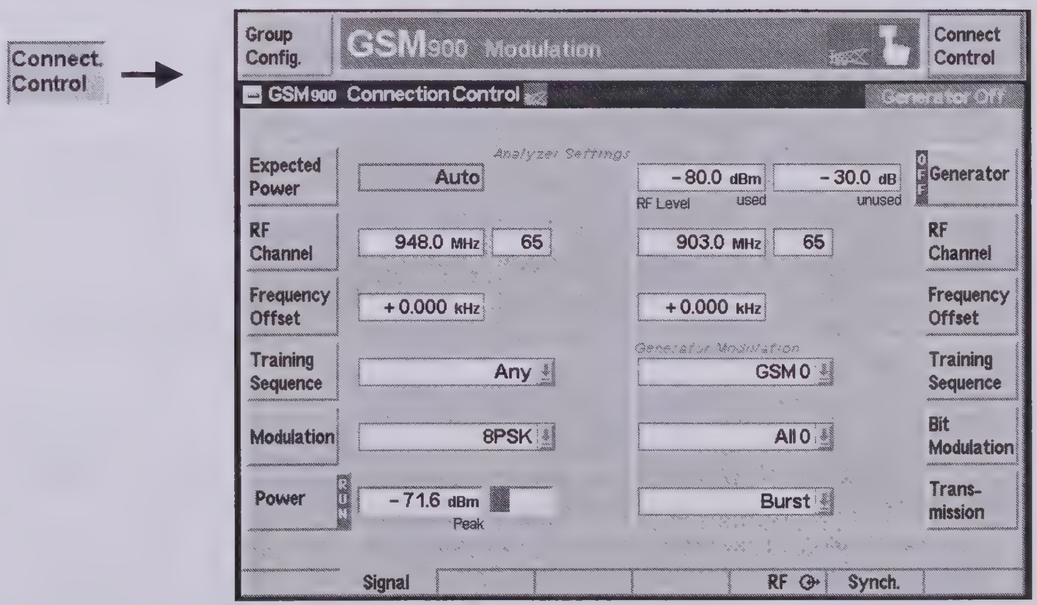
The menu group is activated via the softkey *Connect. Control* to the right of the header of each measurement menu. The individual tabs *(Signal, RF* ⟴ and *Sync.)* are linked to each other via the hotkey bar at the lower edge of the screen.

Control of Input and Output Signals (Connection Control – Signal)

The *Signal* tab configures the RF signals generated by the RF generator of the CMU and those that can be measured by the instrument. Besides it controls the wide-band peak power measurement *(Power)* and indicates the result. In the three configuration panels, the following settings are possible:

- Maximum power *(Expected Power)*, channel *(RF Channel), Frequency Offset, Modulation,* and *Training Sequence* of the signals analyzed *(Analyzer Settings)*
- Level *(RF Level)*, channel *(RF Channel),* and *Frequency Offset* of the signals generated *(RF Generator)*
- Bit modulation sequence *(Bit Modulation)*, *Training Sequence,* and type of *Transmission* of the signals generated *(Generator Modulation)*

All setting values of this menu are also displayed in the main menu *Analyzer/Generator* (see page 4.2).



Expected Power: Auto

RF Channel: 948.0 MHz, 65

Frequency Offset: +0.000 kHz

Training Sequence: Any

Modulation: 8PSK

Power: -71.6 dBm Peak

Generator: RF Level -80.0 dBm used, -30.0 dB unused

RF Channel: 903.0 MHz, 65

Frequency Offset: +0.000 kHz

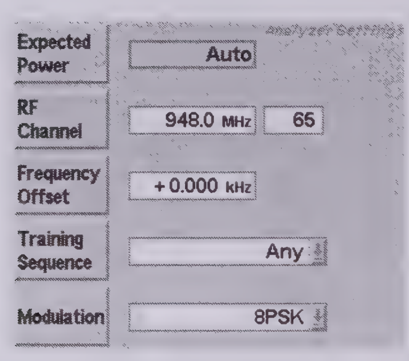
Training Sequence: GSM 0

Bit Modulation: All 0

Trans-mission: Burst

Fig. 4-30 Connection Control – Input and output signals

Panel Analyzer Settings


Analyzer Settings

Expected Power: Auto

RF Channel: 948.0 MHz 65

Frequency Offset: +0.000 kHz

Training Sequence: Any

Modulation: 8PSK

The panel *Analyzer Settings* contains four softkeys which specify

- The maximum expected power from the DUT *(Expected Power)*
- The channel number or frequency *(RF Channel)*
- An additional *Frequency Offset*
- The *Training Sequence* of the signals measured by the CMU
- The traffic channel *Modulation* scheme

Expected Power

The *Expected Power* softkey adjust the input signal path of the CMU to the expected power of the measured signal.

This parameter is identical with the expected power set in the popup menu *Group Configuration* (see page 4.60). The range of values depends on the RF input used. If an external input attenuation is reported to the instrument (see section *RF Connectors (Connection Control – RF Connectors)* on page 4.56), all powers measured are referred to the output of the DUT and therefore shifted with respect to the actual power at the input connectors of the CMU. The power ranges for the input connectors are shifted as well.

Input powers exceeding the *Expected Power* can not be measured; the corresponding measurement result fields indicate "– – –".

In the *Group Configuration* menu, either manual or automatic setting of the input power can be selected. The behavior of the *Expected Power* softkey depends on the way the input power is set:

- In manual mode, the input power is indicated in the input field to the right of the softkey. This field can be activated and the power changed by pressing the softkey once. If the softkey is pressed again, the Group Configuration menu is called up (see page 4.60).
- If autoranging is selected, *Auto* is indicated in the input field to the right of the softkey. This field can not be activated. Instead, if the softkey is pressed once, the *Group Configuration* menu is called up (see page 4.60) to change the input power and mode.

Remote control `[SENSe:]EPOWer:VALue <Power>`

RF Channel

The *RF Channel* softkey defines the channel number or frequency of the measured signal.

The assignment of channel numbers and frequencies is defined in the GSM specification for both directions of transmission. Therefore, it is sufficient to enter only one value (frequency **or** channel number), the other one is automatically determined by the CMU.

The following tables contain the channel assignment in the downlink direction (i.e. from base station to CMU). Channel numbers which are not listed in the tables are not assigned.

Table 4-3 GSM channels in the downlink direction

Frequency / [MHz]	Channel	GSM400 Band
0.2	---	–
460.4	---	
460.6	259	GSM 450 band
467.4	293	
467.6	---	
488.8	---	
489.0	306	GSM 480 band
495.8	340	
496.0	---	–
2700	---	

Frequency / [MHz]	Channel	GSM900 Band
0.2	---	–
921	---	
921.2	955	R-GSM band (European railway netw.)
925	974	
925.2	975	E-GSM band (extended GSM)
934.8	1023	
935.0	0	
935.2	1	P-GSM-Band (primary GSM)
959.8	124	
960	---	–
2700	---	

Frequency / [MHz]	Channel	GSM1800 Band
0.2	---	–
1805	---	
1805.2	512	GSM 1800 band
1879.8	885	
1880	---	–
2700	---	

Frequency / [MHz]	Channel	GSM1900 Band
0.2	---	–
1930	---	
1930.2	512	GSM 1900 band
1989.8	810	
1990	---	–
2700	---	

According to the channel width of the GSM bands, the RF frequency can be set in multiples of 200 kHz. It can be modified by an additional *frequency offset* entered in the input field below.

Remote control `[SENSe:]RFANalyzer:FREQuency <Frequency>`

Frequency Offset

The *Frequency Offset* softkey defines an offset shifting the frequency set under *RF Channel*.

This enables fine tuning of the frequency measured by the CMU.

Remote control `[SENSe:]RFANalyzer:FOFFset <Offset>`

Training Sequence

The *Training Sequence* softkey defines a training sequence for the measured signal.

The training sequence is located in the middle of the symmetrical normal burst and is used for synchronization and to assess the transmission conditions in the RF channel.

TB	Useful Information	F	Training sequence	F	Useful Information	TB	GP

TB	Tail bits (end or start bit)	Bits 0 to 2, 145 to 147
Useful information		Bits 3 to 59, 88 to 144
F	Flag Bit, Stealing Flag	Bits 60, 87
Training sequence		Bits 61 to 86
GP	Guard Period, transmission-free time of 8.25 bit periods	

Fig. 4-31 Bit structure of a GSM normal burst

Here the training sequence is used to distinguish different burst types: If a definite training sequence is specified, the CMU exclusively analyzes bursts with this training sequence. The following settings are provided:

GSM 0 to 7	GSM standard training sequences
Dummy	GSM-specific dummy burst
Off	Training sequence not detected, measurement of all bursts regardless of their training sequence
Any	Automatic detection of the training sequences. The signal is analyzed if one of the sequences defined in the GSM standard (GSM 0 to GSM 7 or Dummy) could be found.

GSM training sequences

The 8 training sequences *GSM 0 to GSM 7* are specified in the GSM standard and read as follows:

TSC	**Bit pattern (Bits No. 61 to 86)**																									
0	0	0	1	0	0	1	0	1	1	1	0	0	0	0	1	0	0	0	1	0	0	1	0	1	1	1
1	0	0	1	0	1	1	0	1	1	1	0	1	1	1	1	0	0	0	1	0	1	1	0	1	1	1
2	0	1	0	0	0	0	1	1	1	0	1	1	1	0	1	0	0	1	0	0	0	0	1	1	1	0
3	0	1	0	0	0	1	1	1	1	0	1	1	0	1	0	0	0	1	0	0	0	1	1	1	1	0
4	0	0	0	1	1	0	1	0	1	1	1	0	0	1	0	0	0	0	0	1	1	0	1	0	1	1
5	0	1	0	0	1	1	1	0	1	0	1	1	0	0	0	0	0	1	0	0	1	1	1	0	1	0
6	1	0	1	0	0	1	1	1	1	1	0	1	1	0	0	0	1	0	1	0	0	1	1	1	1	1
7	1	1	1	0	1	1	1	1	0	0	0	1	0	0	1	0	1	1	1	0	1	1	1	1	0	0

where

TSC	training sequence code for numbering the sequences
Bit pattern	26-bit training sequence

Remote control `[SENSe:]RFANalyzer:TSEQuence <Sequence>`

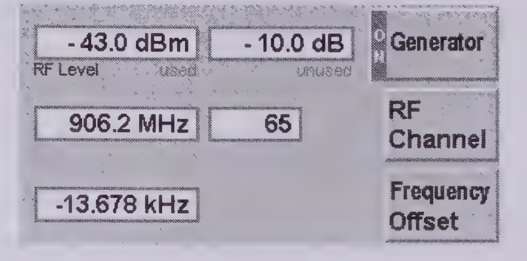
Modulation

The *Modulation* softkey selects the modulation scheme of the RF input signal analyzed.

GMSK or 8PSK-modulated signals can be measured. For 8PSK-modulated channels (EDGE channels), option CMU-K41 is required.

Remote control GMSK and 8PSK modulation is selected by the keywords `:GMSK` and `:EPSK` in the command headers, respectively.

RF Generator Panel


RF Level: - 43.0 dBm (used), - 10.0 dB (unused)

906.2 MHz, 65

-13.678 kHz

The *RF Generator* panel combines three softkeys which define

- The maximum level for the used and unused timeslot (main softkey *RF Generator*)
- The channel number or frequency *(RF Channel)*
- An arbitrary frequency offset *(Freq. Offset)* for the signals generated by the RF generator

Generator

The softkey *Generator* defines the generator level and indicates the operating status of the RF generator *(ON | OFF)*.

For the generator level, a distinction is made between the used timeslot (selected and used for later measurements) and the remaining, unused timeslots. This feature is useful for many tests specified by GSM. E.g. in the “Adjacent Timeslot Rejection” test the adjacent time slot level is set to a higher value than the used time slot level in order to test whether the base station receiver can quickly adapt to fast level changes.

Remote control

```
INITiate:RFGenerator
ABORt:RFGenerator
FETCh:RFGenerator:STATus?
```

Used

The level is indicated as absolute value (in dBm).

Remote control

```
SOURce:RFGenerator:LEVel:UTIMeslot <Level>
```

Unused

The level is indicated relative to the level in the used timeslot (in dB). The absolute level in the unused timeslots, i.e. the sum of numerical values set under *used* and *unused* must lie within the permissible range for the RF Outputs. This condition further restricts the permissible level for the unused timeslots.

External attenuation

If an external gain or attenuation is used and reported to the instrument (see softkey *Ext. Att. Output*) the RF generator level is adjusted to maintain the commanded power after the attenuation or gain. As a consequence, all levels indicated are referred to the input of the DUT and no longer correspond to the actual level at the output connectors of the CMU (see section *RF Connectors (Connection Control – RF Connectors)* on page 4.56). The default value for the generator power is also shifted provided that the generator can output the required power, compensating for the external attenuation or gain. Otherwise it is adapted to the level closest to the shifted default value.

Error messages

If the level defined for *RF Level* is too high or too low, a window will appear with the error message *"<RF_Level> is out of range. <Permissible max. value> is limit*." and three fields:

Accept	Permissible max. value is accepted as *Expected Power*
Re-edit	The *Expected Power* is entered once again
Cancel	The last valid input is maintained

When a different output is selected, the current value of *Expected Power* is automatically adapted, if required:

- Towards lower values to the maximum permissible value of the new output
- Towards higher values to the minimum value of the new output

Remote control

```
SOURce:RFGenerator:LEVel:UNTimeslot <Level>
```

RF Channel

The *RF Channel* softkey defines the channel number or the frequency of the generated RF signal.

The assignment of channel numbers and frequencies is unambiguously defined in the GSM specification for both directions of transmission. Therefore, it is sufficient to enter only one value (frequency **or** channel number), the other one is automatically determined by the CMU.

The following tables contain the channel assignment in the uplink direction (i.e. from CMU to base station). Compared to the downlink, all channel frequencies are shifted by a constant frequency offset depending only on the GSM band (duplex spacing, see above, *Panel Analyzer Settings*): Channel numbers which are not listed in the tables are not assigned.

Table 4-4 GSM channels in the uplink direction

Frequency / [MHz]	Channel	GSM400 Band
0.2 450.4	--- ---	–
450.6 457.4	259 293	GSM 450 band
457.6 478.8	--- ---	
479.0 485.8	306 340	GSM 480 band
486.0 2700	--- ---	–

Frequency / [MHz]	Channel	GSM900 Band
0.2 876	--- ---	–
876.2 880	955 974	R-GSM band (European railway netw.)
880.2 889.8 890.0	975 1023 0	E-GSM band (extended GSM)
890.2 914.8	1 124	P-GSM-Band (primary GSM)
915 2700	 ---	–

Frequency / [MHz]	Channel	GSM1800 Band
0.2 1710	--- ---	–
1710.2 1784.8	512 885	GSM 1800 band
1785 2700	--- ---	–

Frequency / [MHz]	Channel	GSM1900 Band
0.2 1850	--- ---	–
1850.2 1909.8	512 810	GSM 1900 band
1910 2700	--- ---	–

According to the channel width of the GSM bands, the RF frequency can be set in multiples of 200 kHz. It can be modified by an additional *frequency offset* entered in the input field below.

Remote control `SOURce:RFGenerator:FREQuency <Number>`

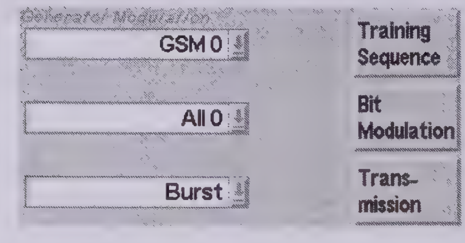
Frequency Offset

The *Freq. Offset* softkey defines a frequency offset shifting the frequency set under RF Channel.

This enables fine tuning of the RF frequency generated by the CMU.

Remote control `SOURce:RFGenerator:FOFFset <Offset>`

Generator Modulation Panel



Generator Modulation

GSM 0 — Training Sequence

All 0 — Bit Modulation

Burst — Transmission

The *Generator Modulation* panel combines three softkeys which

- Select a *Training Sequence*
- Define a *Bit Modulation* sequence for the generated RF signals
- Define the *Transmission* mode (continuous or burst signal)

Training Sequence

The *Training Sequence* softkey defines the training sequence that is modulated on the RF carrier signal.

The following settings are possible:

GSM 0 to 7	GSM standard training sequences
All 0	Training sequence consisting of zeros
Dummy	GSM-specific dummy burst

The 8 GSM standard training sequences are listed above (*Analyzer Settings* Panel on page 4.50).

Remote control

```
CONFigure:RFGenerator:MODulation:TSEQuence
                                GSM0 | ... | GSM7 | ALL0 | DUMMy
```

Bit Modulation

The *Bit Modulation* softkey defines a bit sequence that is modulated onto the RF carrier signal.

The following types of modulation sequence can be selected:

Off	No signal superimposed, "empty" carrier
All 0	Modulation sequence consisting of zeros
PRBS	Pseudo random bit sequence
Dummy Bursts	Fixed bit sequences (Dummy Bursts) with selectable training sequence
8PSK All 0	Modulation sequence consisting of zeros, 8PSK modulation
8PSK PRBS	Pseudo-random bit sequence, 8PSK modulation

Remote control

```
CONFigure:RFGenerator:MODulation:BMODulation
       OFF | PRBS | DUMMy | ALL0 | EALL0 | EPRBS
```

Trans-mission

The softkey *Transmission* determines the shape of the generated RF signal.

The RF generator generates either a burst or a continuous signal, i.e. a carrier with a constant level.

Remote control

```
CONFigure:RFGenerator:MODulation:TRANsmission
                                BURSt | CONTinuous
```

Wide-Band Power

Power

The *Power* softkey controls the wide-band power measurement and indicates its state *(RUN | HLT | OFF)*.

The state can be changed after softkey selection (pressing once) by means of the *ON/OFF* key or the *CONT/HALT* key. The measurement result in units of dBm. The analog bar to the right of the softkey shows the measured power relative to the

Expected Power defined in the *Analyzer Settings* panel.

The result of the wide-band power measurement is usually slightly higher than the result of the *Power* measurement which is obtained with different filter characteristics.

Remote control

```
INITiate:WPOWer etc.
FETCh:WPOWer:STATus?
READ[:SCALar]:WPOWer?
FETCh[:SCALar]:WPOWer?
SAMPle[:SCALar]:WPOWer?
```

RF Connectors (Connection Control – RF Connectors)

The *RF Connectors* tab configures the connectors for RF signals. This includes the setting of

- The RF input and output of the CMU *(RF Output, RF Input)*
- An external attenuation at the connectors *(Ext. Att. Output, Ext. Att. Input)*

Besides, the tab lets you control the wide-band power measurement *(Power)* and indicates its result; see section *Wide-Band Power* on page 4.55.

Connect Control →

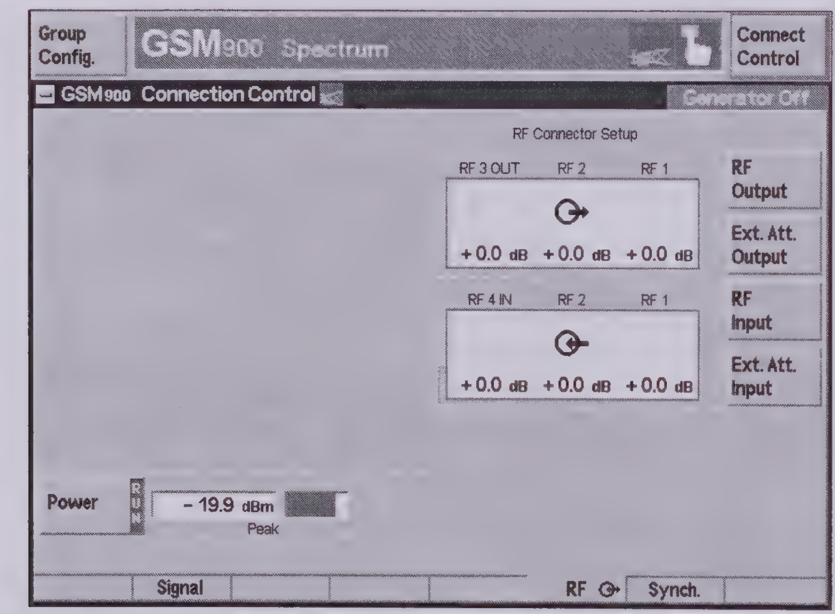

Group Config.
GSM900 Spectrum
Connect Control
GSM900 Connection Control
Generator Off
RF Connector Setup
RF 3 OUT
RF 2
RF 1
+0.0 dB
+0.0 dB
+0.0 dB
RF Output
Ext. Att. Output
RF 4 IN
RF 2
RF 1
+0.0 dB
+0.0 dB
+0.0 dB
RF Input
Ext. Att. Input
Power
RUN
- 19.9 dBm
Peak
Signal
RF
Synch.

Fig. 4-32 Connection Control – RF connectors

RF Output

The *RF Output* softkey defines which of the three connectors RF 1, RF 2 and RF 3 OUT is to be used as *RF Output* connector.

A symbol ⇴ indicates the selected *RF Output*.

Note: *Input and output connectors can be arbitrarily combined. The bidirectional connectors RF 1 and RF 2 can be selected as RF inputs and outputs at the same time.*

The LEDs on the front panel are only „on" (light) if the output level is switched on.

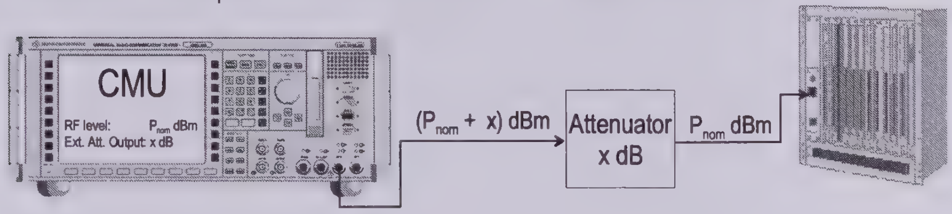
Remote control `OUTPut[:STATe] RF1 | RF2 | RF3`

Ext. Att. Output

The softkey *Ext. Att. Output* defines an external attenuation (or gain, if the value is negative) at the selected *RF Output*.

Input of an external attenuation is suitable if, for example, if a path attenuation (cable) is included in the test setup, which is to be corrected by an increased signal level.

If an external attenuation is defined, the output signal level is referred to the input of the DUT, the generator level is therefore shifted with respect to the actual level at the input connector of the CMU. The default value for the generator power and the level ranges for the RF outputs are also shifted provided that the generator can output the required power, compensating for the external attenuation or gain. Otherwise it is adapted to the level closest to the shifted default value.



Remote control

```
[SENSe:]CORRection:LOSS:OUTPut<nr>[:MAGNitude]
SOURce:CORRection:LOSS:OUTPut<nr>[:MAGNitude]
```

RF Input

The *RF Input* softkey determines which of the three connectors RF 1, RF 2 and RF 4 IN is to be used as RF input connector.

If a connector is selected as RF input, a symbol ⟜ will appear in the respective field. Input and output connectors can be arbitrarily combined.

Remote control

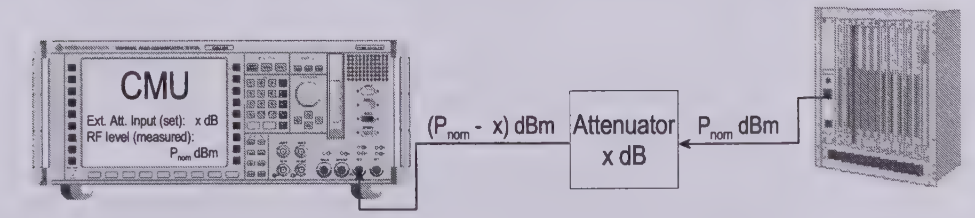
```
INPut[:STATe] RF1 | RF2 | RF4
```

Ext. Att. Input

The softkey *Ext. Att. Input* enters the value of the external attenuation (or gain) at the selected RF input.

Input of an external attenuation is required if, for example, external attenuator pads are used for protection of the sensitive RF inputs of the CMU or if a path attenuation is included in the test setup.

If an external input attenuation is reported to the instrument (see section *RF Connectors (Connection Control – RF Connectors)* on page 4.56), all powers measured are referred to the output of the DUT and therefore shifted with respect to the actual power at the input connectors of the CMU. The power ranges for the input connectors are shifted as well.



Note: *The LEDs on the front panel are only ON (light) if the measurement is active.*

Remote control

```
[SENSe:]CORRection:LOSS:INPut<nr>[:MAGNitude]
SOURce:CORRection:LOSS:INPut<nr>[:MAGNitude]
```

Reference Frequency (Connection Control – Synch.)

The *Synch.* tab defines the reference signals for synchronization. This includes

- The internal or external *Reference Frequency*
- Configuration of the network-specific system clock *(REF OUT 2)*

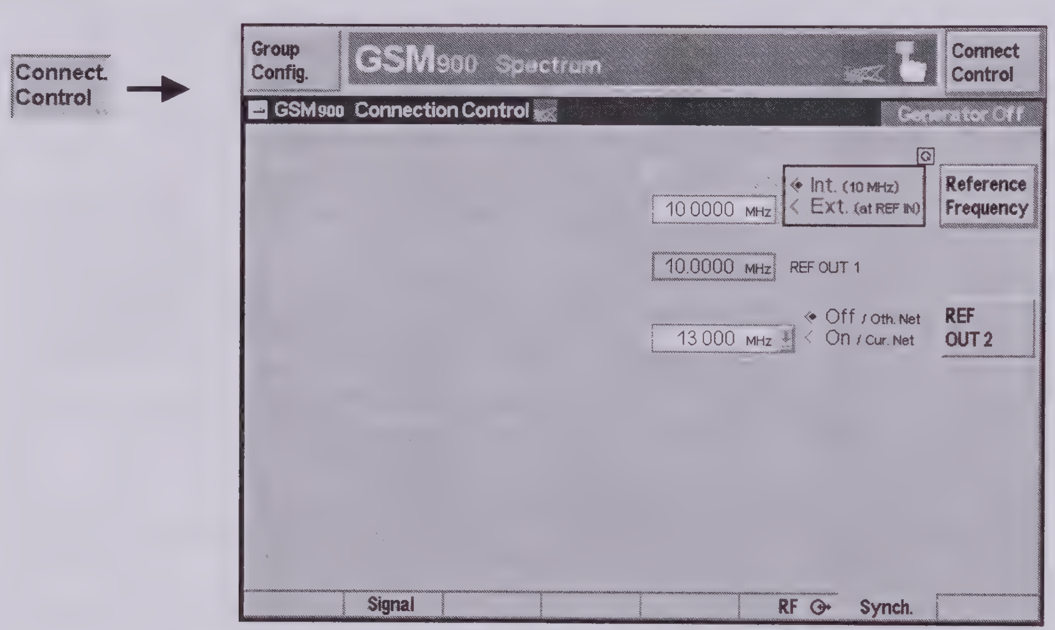

Connect. Control
Group Config.
GSM900 Spectrum
Connect Control
GSM900 Connection Control
Generator Off
10.0000 MHz
◆ Int. (10 MHz)
< Ext. (at REF IN)
Reference Frequency
10.0000 MHz
REF OUT 1
13.000 MHz
◆ Off / Oth. Net
< On / Cur. Net
REF OUT 2
Signal
RF
Synch.

Fig. 4-33 Connection Control – Synchronization

Reference Frequency

The *Reference Frequency* softkey determines the source and the frequency of the reference signal.

The associated field permits to select between two alternatives:

Int. (10 MHz)	Internal synchronization with 10 MHz (TCXO or OCXO, CMU-B11/-B12) applied to output REF OUT 1 at the rear of the instrument.
Ext. (at REF IN)	External reference signal to be fed in via input *REF IN* and applied to output REF OUT 1 at the rear of the instrument.

The frequency of the external reference signal must be entered in the input field next to the left of the *Ext. (at REF IN)* radio button.

The reference signal used is applied to output *REF OUT 1* so that it can be fed to other instruments as well. It can be used for synchronization to another instrument.

Notes:

1. *With external synchronization selected, the header cyclically displays a warning if no synchronization has been performed e.g. because of missing or faulty input signal.*
2. *In the case of external synchronization with squarewave signals (TTL) ensure correct signal matching to avoid reflections. Otherwise, resulting overshoots may cause trigger problems at the CMU input. A possible remedy is to use a lowpass filter or an attenuator pad directly at the CMU input. Correct synchronization may be checked by comparing the signal REF OUT 1 or REF OUT 2 with the input signal.*
3. *This configuration is valid in **all** CMU function groups.*

Remote control

```
CONFigure:SYNChronize:FREQuency:REFerence:MODE <ON | OFF>
CONFigure:SYNChronize:FREQuency:REFerence <Frequency>
```

REF OUT 2

The softkey *REF OUT 2* configures a network-specific system clock REF OUT 2 to be fed to the output *REF OUT 2* at the rear of the instrument.

The associated field permits to select between two alternatives:

OFF (other network)	The clock frequency of the current function group is not fed to the output *REF OUT 2*. With this setting the system clock of another active function group (e.g. the network GSM1800 while the current network is GSM900) is still applied to *REF OUT 2* provided that the output *REF OUT 2* is switched on in the other function group. However, if *REF OUT 2* is explicitly switched over from *On* to *Off* the clock signal is definitely removed.
On (current network)	The network-specific system clock of the current function group is fed to output REF OUT 2. The system clock of any other function group applied to REF OUT 2 before is replaced.

Besides the basic clock frequency of 39 MHz one of the following clock frequencies may be selected:

39.000 MHz, 19.500 MHz, 13.000 MHz, 9.750 MHz, 7.800 MHz, 6.500 MHz, 5.571 MHz,
4.875 MHz, 4.333 MHz, 3.900 MHz, 3.545 MHz, 3.250 MHz, 3.000 MHz, 2.786 MHz,
2.600 MHz, 2.438 MHz, 2.294 MHz, 2.166 MHz, 2.053 MHz, 1.950 MHz, 1.857 MHz,
1.773 MHz, 1.696 MHz, 1.625 MHz, 1.560 MHz, 1.500 MHz, 1.444 MHz, 1.393 MHz,
1.349 MHz, 1.300 MHz, 1.258 MHz, 1.219 MHz

(The values are calculated according to the formula $F_{out} = 39.000\ MHz\ /\ n$ where $n = 1, ..., 32$.)

The clock frequency can be used to synchronize other instruments.

Remote control

```
SOURce:DM:CLOCk:STATe ON | OFF
SOURce:DM:CLOCk:FREQuency <Frequency>
```

Group Configuration

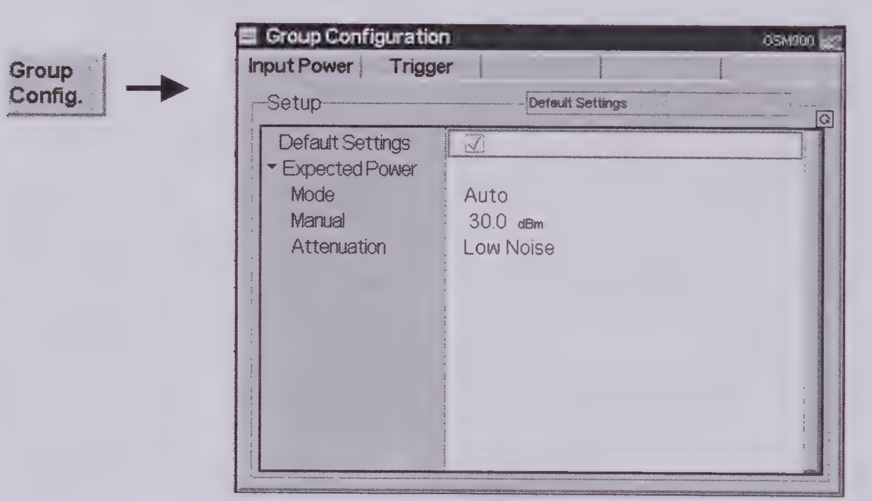
The popup menu *Group Configuration* contains two tabs which configure the measurements in the function group GSM400/900/1800/1900-BTS globally, i.e. for all subsequent measurement menus. Most of the settings made here can be changed for a single measurement, if required, directly in the graphical measurement menu using softkeys and popup input fields.

The popup menu *Group Configuration* can be activated by pressing the softkey *Group Config.* at the top left in each measurement menu. It is possible to change between the tabs by pressing the associated hotkeys.

Input Power (Group Configuration – Input Power)

The tab *Input Power* provides settings for the measured input power (see also section *Connection Control* on page 4.49):

- Maximum expected input power from the DUT *(Expected Power)*
- Attenuation or gain *(Attenuation)*



Default Settings ☑
Expected Power
Mode Auto
Manual 30.0 dBm
Attenuation Low Noise

Fig. 4-34 Group Configuration – Input power

Default Settings The *Default Settings* switch overwrites all settings in the *Input Power* tab with their default values. See command description in chapter 6.

Remote control `DEFault:EPOWer ON | OFF`

Expected Power The *Expected Power* field sets the input attenuator and thus determines the maximum input **power** which can be measured. The maximum input **power** is displayed next to the softkey *Expected Power* in the main menu *Analyzer/Generator* (see page 4.2).

Manual	Manual input of maximum expected input **power**
Auto	Automatic setting of maximum input **power** (autoranging) according to average burst power of applied signal

Remote control `[SENSe:]EPOWer:VALue <Power>`

Input **powers** exceeding the *Expected Power* can not be measured; the corresponding measurement result fields indicate "– – –".

Error messages

If the value determined for *Expected Power* is too high or too low, a window with the error message *"<Max_Level> is out of range. <permissible max. value> is limit."* and three fields will appear:

Accept	The permissible max. value is accepted as Expected Power
Re-edit	Expected Power is entered once again
Cancel	The last valid input value is maintained

When switching over to another input, the current value of *Expected Power* is automatically adapted, if required:

- Towards lower values to the maximum permissible value of the new input,
- Towards upper values to the minimum value of the new input.

Note: *A maximum input power can be entered even if automatic level setting (autoranging) is selected. This power is used as initial value for the autoranging procedure; it also ensures safe switchover to manual setting.*

Attenuation

The *Attenuation* field defines how the RF analyzer of the CMU is tuned to meet the requirements of the current measurement type. In general, a compromise between the acceptable noise level in the displayed result and the contribution of internally generated distortion must be reached.

Normal	Mixer level in normal range,
Low noise	Mixer level enhanced by +10 dB (full dynamic range of CMU, therefore recommended for *Power* and *Spectrum* measurements),
Low distortion	Mixer level reduced by –10 dB (high intermodulation spacing, therefore recommended for modulation measurements).

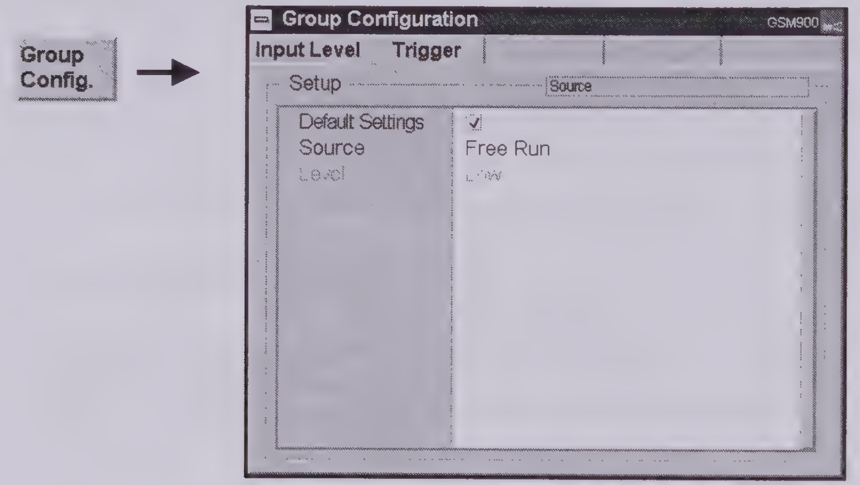
The *Attenuation* setting permits the CMU to be adapted to the requirements of the measurement. The advantages and disadvantages of the settings *Low noise* and *Low distortion* are listed in the following table.

	Advantages	**Disadvantages**
Low noise	Low noise High dynamic range	No RF overdrive reserve Risk of intermodulation
Low distortion	High intermodulation spacing	Lower dynamic range

Remote control `[SENSe:]EPOWer:ATTenuation <Mode>`

Trigger (Group Configuration – Trigger)

The tab *Trigger* defines the trigger condition for the measurement.



Default Settings	☑
Source	Free Run
Level	Low

Fig. 4-35 Group Configuration – Trigger

Default The field *Default* assigns the default setting to all fields of the tab *Trigger*.

Remote control `DEFault:TRIGger[:SEQuence] ON | OFF`

Trigger The *Trigger* field determines how the measurement is to be triggered:

Free Run	Triggering via TDMA timing (synchronization information in the training sequence)
RF Power	Triggering on the power (rising edge) of the incoming burst, broad-band trigger
IF Power	Narrow-band trigger
Extern	External trigger signal fed in via connector AUX3 (pin no. 8)

For the *RF Power* and *IF Power* parameters the signal to be measured must be a burst signal.

The external trigger can be selected for all *Non Signalling* measurements. In contrast, *Signalling* measurements must be triggered by a signal from the signalling unit or from the base station.

Remote control
```
TRIGger[:SEQuence:]SOURce
                    FRUN | RFPOWer | IFPOWer | EXTern
```

Level The *Trigger Level* field determines the trigger threshold if the measurement is triggered by the *RF Power* or *IF Power*.

The trigger threshold is the level at which the trigger signal starts triggering. With free-run measurements or external trigger the *Trigger Level* field is disabled.

Low	Low trigger level equal to the reference level –26 dB
Medium	Medium trigger level equal to the reference level –16 dB
High	High trigger level equal to the reference level –6 dB

Remote control `TRIGger[:SEQuence]:THReshold LOW | MEDium | HIGH`

GSM BTS Tests (Signalling)

The structure of this section is based on the configuration and measurement groups defined in function group *GSM400/900/1800/1900-BTS Signalling*, i.e. on the menus of the graphical user interface. The menus are dealt with in the order of their operation:

1. Synchronization to the base station *(Connection Control – Signal)*
2. Overview of measurements and general settings *(Overview)*
3. Measurement menus *(Power, Modulation, Spectrum, Receiver Quality):* performance of the measurements, output of measurement results, specific measurement configurations
4. Global configurations *(Connection Control, Group Configuration)*

A lot of menus and controls are identical in the two operating modes for *GSM400/900/1800/1900-BTS* with and without signalling. These menus will be presented with a summary explanation; the detailed description can be found in the section *GSM400/900/1800/1900-BTS Non Signalling*.

Call Setup (Popup Menu Connection Control – Signalling)

The menu group *Connection Control* controls the signalling procedures (call setup and release, services, signalling parameters) and configures the inputs and outputs with the external attenuation values and the reference frequency.

The term signalling summarizes all procedures that are necessary for call setup and release and for control of a connection in the mobile radio network. In the case of the GSM base station measurements, the following main signalling states are distinguished:

Unsynchronized	No synchronization with the base station signals. As no hardware resources are available in this state, no measurements can be performed. To carry out measurements which do not require synchronization use the *Non Signalling* mode.
CCH Test	Synchronization to the base station succeeded, control channel test.
TCH Test	Synchronization to the base station succeeded, traffic channel test.
Call Established	Call to base station succeeded, traffic channel test

These main signalling states are reached via intermediate signalling states. In the intermediate states, no measurements can be performed. The following intermediate states are defined:

Synchronizing	The BTS transmits a GSM control channel signal to which the CMU can synchronize.
Location Update	A location update is being performed (substate *Location Update in Progress*) or an error occurred during a location update (substate *Location Update Failed*)
Call	A call to the base station (MOC) or from the base station (MTC) is being set up (substate *Call in Progress*) or an error occurred during call setup (substate *Call Failed*)
Call Release	A call release is being performed (substate *Call Release in Progress*) or an error occurred while the call connection was released (substate *Call Release Failed*)

A number of control commands which can be initiated both by the CMU *(Mobile Originated Call, MOC)* and by the base station *(Mobile Terminated Call, MTC)* switch over between these states (see Fig. 4-36; processes initiated by the base station or automatic processes are indicated by dashed lines).

The CMU provides different synchronization modes to better meet the requirements of different test cases. The synchronization mode is selected and configured before the synchronization is started; it will have an impact both on the *Synchronizing* state and on the test mode reached after successful synchronization. For more information see *Sync. Mode* softkey on page 4.67.

Many applications within the function group *GSM400/900/1800/1900-BTS Signalling* are only possible in a particular signalling state (for example, as EDGE channels are exclusively used for data transfer, all 8PSK measurements must be performed in the TCH Test mode, whereas the corresponding measurement configurations may be defined in any signalling state). Therefore, the menus and their functionality vary according to the signalling states. For reference see the *Status* field in the command tables in Chapter 6.

As the *Signalling* measurements require a synchronization between the CMU and the BTS, the corresponding menus (*Connection Control – Signalling)* appear immediately after the function group and mode *GSM400/900/1800/1900-BTS Signalling* is activated. Besides, all the tabs in the *Connection Control* menu can be called up by pressing the *Connect. Control* softkey at the top right in every measurement menu. They are linked with each other via the hotkey bar at the lower edge of the screen. By pressing the *Escape* key, the active *Connection Control* menu is closed and the CMU changes to one of the measurement menus.

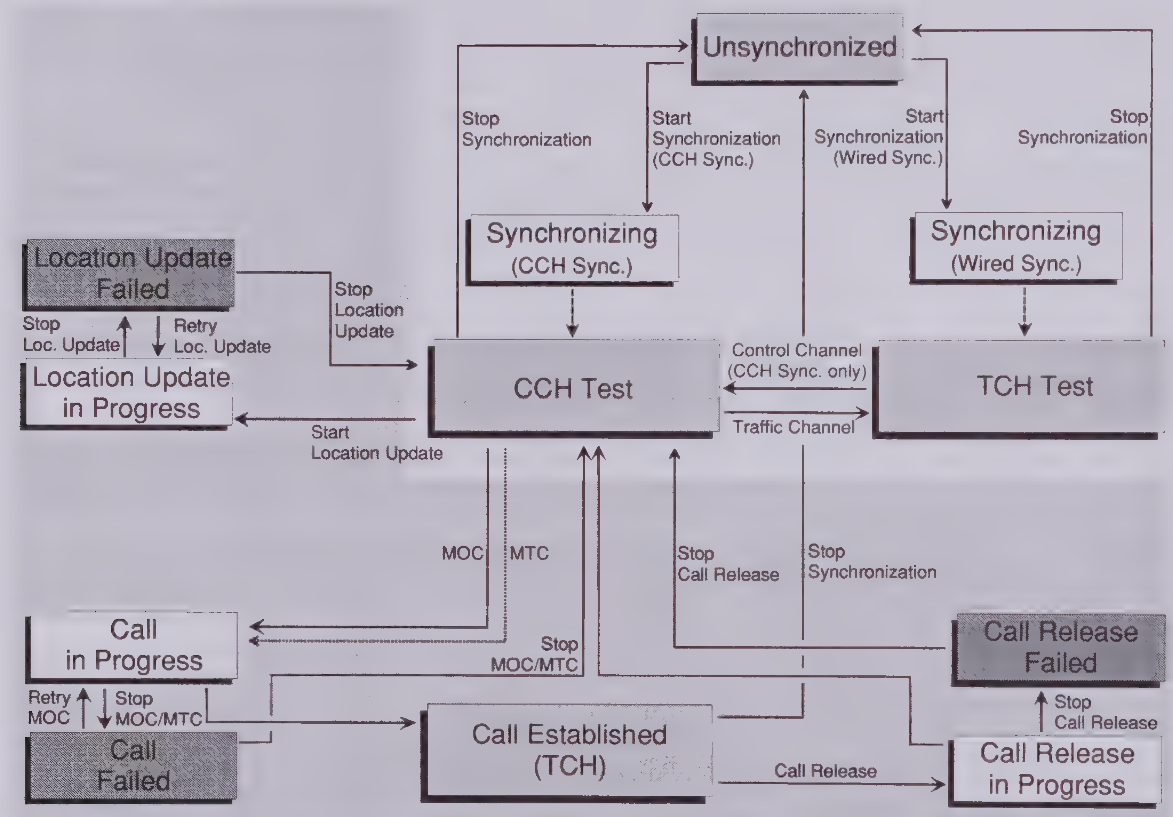

Unsynchronized
Stop Synchronization
Start Synchronization (CCH Sync.)
Start Synchronization (Wired Sync.)
Stop Synchronization
Synchronizing (CCH Sync.)
Synchronizing (Wired Sync.)
Location Update Failed
Stop Location Update
Stop Loc. Update
Retry Loc. Update
Location Update in Progress
CCH Test
Control Channel (CCH Sync. only)
TCH Test
Traffic Channel
Start Location Update
MOC
MTC
Stop Call Release
Stop Synchronization
Call in Progress
Stop MOC/MTC
Call Release Failed
Retry MOC
Stop MOC/MTC
Stop Call Release
Call Failed
Call Established (TCH)
Call Release
Call Release in Progress

Fig. 4-36 Signalling states of the CMU

Note: *The* Call Established (TCH) *state and all other states in the shaded area in Fig. 4-36 are available with option CMU-K39 only.*

Each of the signalling states in Fig. 4-36 is assigned a different *Signalling* tab in the *Connection Control* menu. When *the CCH Test* signalling state is reached, the corresponding menu is opened automatically (exception: see softkey *Open Pop. autom.*).

In the following the *Connection Control – Signalling* tabs displayed during the call setup are described. The other tabs of the *Connection Control* menu are relegated to the end of this chapter (see section Popup Menu Connection Control on page 4.97 ff).

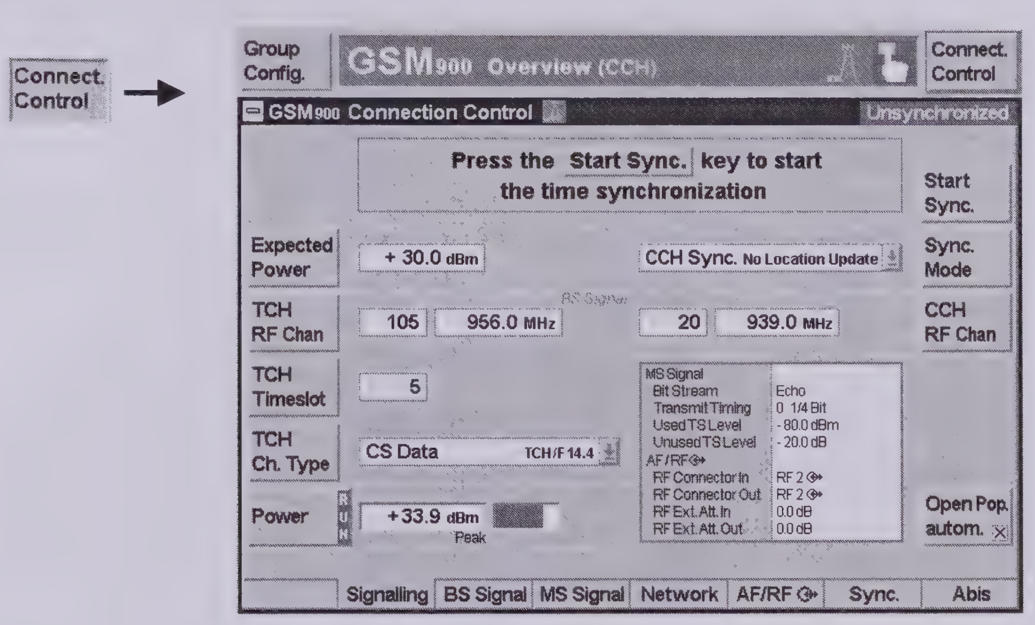
Signalling Control (State Unsynchronized)

The *Signalling (Unsynchronized)* tab configures the traffic and control channels and initiates synchronization between the CMU and the base station. It defines

- The maximum expected power *(Expected Power)*, channel *(TCH RF Channel), TCH Timeslot,* and data type *(TCH Ch. Type)* of the BTS traffic channel to be analyzed (panel *BTS Signal)*
- Synchronization mode *(Sync. Mode)* and related settings *(CCH RF Chan)*

Besides, it provides the following information:

- Status and result of wide band peak-power measurement (Power)
- Level of the signal transmitted by the CMU to which the base station can synchronize (MS Signal)
- Selected RF connectors and external attenuation (AF/RF ⊖→) and activates the synchronization process (Start Sync.).


Connect. Control
Group Config.
GSM900 Overview (CCH)
Connect. Control
GSM900 Connection Control
Unsynchronized
Start Sync.
Sync. Mode
CCH RF Chan
BS Signal
Open Pop. autom. ☒
Signalling
BS Signal
MS Signal
Network
AF/RF ⊖→
Sync.
Abis

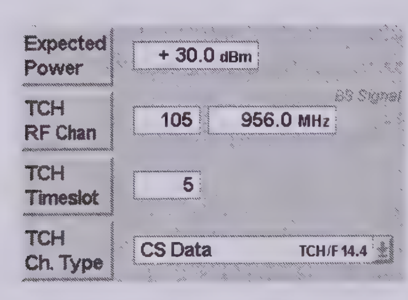
Press the Start Sync. key to start the time synchronization

Expected Power: + 30.0 dBm
CCH Sync. No Location Update
TCH RF Chan: 105 956.0 MHz
CCH RF Chan: 20 939.0 MHz
TCH Timeslot: 5
TCH Ch. Type: CS Data TCH/F 14.4
Power: +33.9 dBm Peak

MS Signal
Bit Stream: Echo
Transmit Timing: 0 1/4 Bit
Used TS Level: - 80.0 dBm
Unused TS Level: - 20.0 dB
AF / RF ⊖→
RF Connector In: RF 2 ⊖→
RF Connector Out: RF 2 ⊖→
RF Ext. Att. In: 0.0 dB
RF Ext. Att. Out: 0.0 dB

Fig. 4-37 Connection Control – Signalling (Signal Off)

Panel BTS Signal



Expected Power: + 30.0 dBm
TCH RF Chan: 105 956.0 MHz
TCH Timeslot: 5
TCH Ch. Type: CS Data TCH/F 14.4

The panel *BTS Signal* contains three softkeys which specify

- The maximum expected power *(Expected Power)*
- The channel number or frequency *(TCH RF Channel)*
- The *Timeslot*
- The data type *(TCH Ch. Type)* of the traffic channel signal transmitted by the base station

Expected Power

The *Expected Power* softkey sets the input attenuator and thus determines the maximum input power which can be measured.

This parameter is identical with the *Expected Power* in the popup menu *Group Configuration* (see page 4.60).

Remote control `[SENSe:]EPOWer:VALue <Power>`

TCH RF Chan.

The *TCH RF Chan.* softkey defines the channel number and corresponding frequency of the BTS traffic channel signal to be measured.

Only one value needs to be entered, the other one is determined by the CMU according to the tables in section *Control of Input and Output Signals* (downlink, see page 4.49 ff).

Remote control `CONFigure:BSSignal:TCH:CHANnel <ChannelNo>`

TCH Timeslot	The *TCH Timeslot* softkey defines the timeslot of the BTS traffic channel signal to be measured.
Remote control	`CONFigure:BSSignal:TCH:TIMeslot <TimeslotNo>`
TCH Chan. Type	The *TCH Chan. Type* softkey defines the coding scheme and the transmission rate in the BTS traffic channel.

The following options are provided:

Speech TCH/FS	Standard full rate speech coding
Speech TCH/EFS	Enhanced full rate speech coding
Speech TCH/HS	Half rate speech coding
CS Data TCH/F14.4	Full rate data with a transmission rate of 14 400 baud
CS Data TCH/F9.6	Full rate data with a transmission rate of 9 600 baud
CS Data TCH/F4.8	Full rate data with a transmission rate of 4 800 baud
CS Data TCH/H4.8	Half rate data with a transmission rate of 4 800 baud
CS Data TCH/H2.4	Half rate data with a transmission rate of 2 400 baud
ECSD E-TCH/F43.2NT	Extended full rate data (EDGE) at 43 200 baud

Note: *The* ECSD E-TCH/F43.2NT *channel type must be used for all 8PSK measurements.*

Remote control `CONFigure:BSSignal:TCH:CHTYpe <Type>`

Wide-Band Power

Power

The *Power* softkey controls the wide-band power measurement and indicates its state *(RUN | OFF | HLT)*.

The state can be changed after softkey selection (pressing once) by means of the *ON/OFF* key or the *CONT/HALT* key. The measurement result in units of dBm. The analog bar to the right of the softkey shows the measured power relative to the *Expected Power* defined in the *Analyzer Settings* panel.

The result of the wide-band power measurement is usually slightly higher than the result of the *Power* measurement which is obtained with different filter characteristics.

Remote control

```
INITiate:WPOWer
FETCh:WPOWer:STATus?
READ[:SCALar]:WPOWer?
FETCh[:SCALar]:WPOWer?
SAMPle[:SCALar]:WPOWer?
```

Synchronization

Start Sync.

The *Start Sync.* softkey initiates the synchronization process.

On pressing this softkey, the CMU changes to the signalling state *Synchronizing*. Synchronization (and thus the *Synchronizing* state) depends on the *synchronization mode*, see below.

Remote control `PROCedure:SIGNalling:ACTion SRUN`

Sync. Mode

The *Sync. Mode* softkey selects the synchronization mode.

The synchronization mode defines which type of signal is to provide the timing information. As shown in the table below, the synchronization mode governs the softkey *CCH RF Chan. / Training sequence*, the *Synchronizing* tab, (see section *Signalling Control (State Synchronizing)* on page 4.68) and determines which test mode will be active after a successful synchronization. The following modes are provided:

No Loc. Update CCH (fix)	The timing information is provided by a control channel signal from the BTS under test received via the current RF connector. The channel number of the CCH signal can be set by means of the *CCH RF Chan.* softkey.
Wired Sync. (Ext. Trigger)	The timing information is provided by an external trigger signal (TTL) fed in via connector AUX3 (pin no. 6). The training sequence of the BTS traffic channel signal can be set by means of the *Training Sequence* softkey.

Wired synchronization is a means of circumventing CCH synchronization if no *CCH Test* is desired or possible and no call to the BTS needs to be established. The CMU synchronizes to the SACCH (frame no. 13) of a traffic channel multiframe consisting of 26 TDMA frames (26-multiframe trigger). No control channel signal from the base station is needed. In general wired synchronization is faster than CCH synchronization. Moreover, it is suitable in all test scenarios where the presence of a control channel could possibly impair the measurement.

In addition to the training sequence (GSM0 to GSM7) of the SACCH frames, the CMU exploits information such as the rising or falling edge of the TTL trigger signal for synchronization purposes. These trigger parameters can be set in the *Sync.* tab of the *Connection Control* menu (see p. 4.109 ff).

Sync. Mode	**CCH RF Chan. / TSC**	**Synchronizing Menu Message**	**Test Mode after Sync.**
No Loc. Update CCH (fix)	CCH RF Chan.	"Searching for a Control Channel..."	CCH Test
Wired Sync. (External Trigger)	Training Sequence	"Waiting for external trigger"	TCH Test

Remote control `CONFigure:SIGNalling:SMODe NUBCch | NUETrg`

CCH RF Chan.

The *CCH RF Chan.* softkey defines the channel number and corresponding frequency of the CCH signal (C0 carrier) used for synchronization.

Only one value needs to be entered, the other one is determined by the CMU according to the tables in section *Control of Input and Output Signals* (downlink, see page 4.49 ff).

The *CCH RF Chan.* softkey is available in the synchronization modes *No Loc. Update CCH (fix)*. In the synchronization mode *Wired Sync. (External Trigger)*, it is replaced by the *Training Sequence* softkey described below.

Remote control `CONFigure:SIGNalling:CCH:CHANnel <ChNumber>`

Training Sequence

The *Training Sequence* softkey defines a training sequence for the BTS traffic channel signal.

The following settings are possible:

GSM 0 to 7	GSM standard training sequences

The *Training Sequence* softkey is available in the synchronization mode *Wired Sync. (External Trigger)* only. In the synchronization mode *No Loc. Update CCH* *(fix)*, the CMU determines the training sequence of the CCH signal from the BTS; the TCH training sequence is taken to be equal to this CCH training sequence. The *Training Sequence* softkey is replaced by the *CCH RF Chan.* softkey described above.

Remote control `CONFigure:BSSignal:TCH:TSEQuence <Sequence>`

MS Signal The table *MS Signal* indicates the parameters of the MS traffic channel signal provided by the CMU. These parameters are set in the *MS Signal* tab (see page 4.104 ff).

Remote control `CONFigure:MSSignal...`

AF/RF ⊖→ The table *AF/RF* ⊖→ indicates the RF connectors and external attenuation values set. These parameters are set in the tab *AF/RF* ⊖→ (see page 4.56 ff).

Remote control

```
INPut[:STATe]?
OUTPut[:STATe]?
[SENSe:]CORRection:LOSS:INPut<nr>[:MAGNitude]?
SOURce:CORRection:LOSS:OUTPut<nr>[:MAGNitude]?
```

Open Pop. autom. The *Open Pop. autom.* softkey contains a field which activates or suppresses display of the *Connection Control* menu.

- In the default setting (*Open Pop. autom.* on), the *Connection Control* menu is displayed each time the signalling state or the function group is changed.
- In the alternative setting (*Open Pop. autom.* off), the popup menu is suppressed. However, the *Connection Control* menu can be opened explicitly by pressing the *Connect. Control* softkey.

Remote control –

Signalling Control (State Synchronizing)

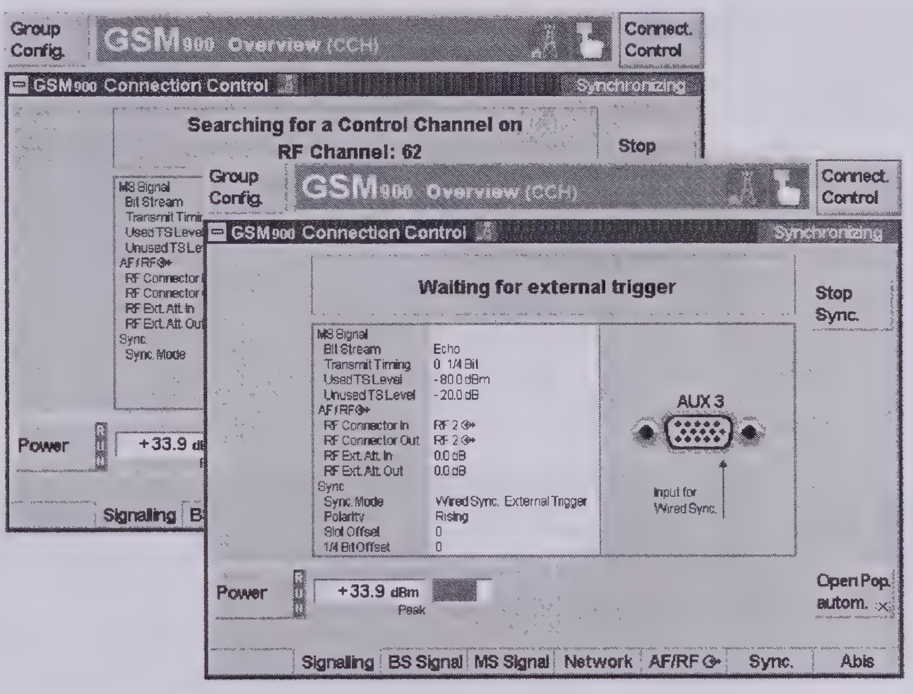
The *Signalling (Synchronizing)* tab provides information on:

- The synchronization process (message box)
- Parameters of the MS (CMU) signal transmitted back to the BTS under test *(MS Signal)*
- The RF connectors and external attenuation values set *(AF/RF ⊖→)*
- The status and result of the peak power measurement *(Power)*

Besides, the *Stop Sync.* softkey can be used to return to the *Unsynchronized* state.

Depending on the synchronization mode (synchronization by means of the CCH from the base station or wired synchronization, see *Sync. Mode* softkey on p. 4.67), the *Synchronizing* tab occurs in two different versions:

Connect. Control →


Group Config.
GSM900 Overview (CCH)
Connect. Control
GSM900 Connection Control
Synchronizing
Stop
Stop Sync.
AUX 3
Input for Wired Sync.
Power
+33.9 dBm
Peak
Open Pop. autom.
Signaling
BS Signal
MS Signal
Network
AF/RF
Sync.
Abis

Searching for a Control Channel on RF Channel: 62

Waiting for external trigger

MS Signal	
Bit Stream	Echo
Transmit Timing	0 1/4 Bit
Used TS Level	-80.0 dBm
Unused TS Level	-20.0 dB
AF/RF	
RF Connector In	RF 2
RF Connector Out	RF 2
RF Ext. Att. In	0.0 dB
RF Ext. Att. Out	0.0 dB
Sync	
Sync. Mode	Wired Sync. External Trigger
Polarity	Rising
Slot Offset	0
1/4 Bit Offset	0

Fig. 4-38 Connection Control – Signalling (Synchronizing)

The information displayed in the *MS Signal* and *AF/RF* table sections, the *Power* and the *Open Pop. autom.* softkey is described in section *Signalling Control (State Unsynchronized)* on page 4.64. Note that, if wired synchronization is selected, the input connector for the signal *(AUX3)* with the appropriate input pin (pin no. 6) is displayed in addition.

Stop Sync.	The *Stop Sync.* softkey stops the synchronization process. The CMU returns to the signalling state *Unsynchronized,* see p. 4.64.
Remote control	`PROCedure:SIGNalling:ACTion SSTP`
Sync.	The *Sync.* table indicates the synchronization mode set via the *Sync. Mode* softkey; see p. 4.67. For wired synchronization, parameters that further control the synchronization process are displayed in addition. These parameters are set in the *Sync.* tab of the *Connection Control* menu; see page 4.109 ff.
Remote control	`CONFigure:SIGNalling:SMODe <Mode>` `CONFigure:EXTernal[:TRIGger][:INPut]...`

Signalling Control in the CCH Test State

The *Signalling (CCH Test)* tab provides information on

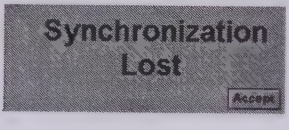
- The maximum expected power from the DUT *(Expected Power)*, the channel number *(TCH RF Channel), Timeslot,* and *TCH Ch. Type* of the BTS traffic channel to be analyzed (panel *BTS Signal)*
- The Status and result of peak-power measurement *(Power)*
- An overview of important channel and network data *(Signalling Info)*

Besides, it contains softkeys which lead to other signalling states:

- Release of the synchronization *(Stop Sync.* state *Unsynchronized)*

- Switchover to traffic channel test *(Traffic Channel* state *TCH Test)*
- Initiating a location update *(Location Update* state *Location Update, with option CMU-K39 only)*
- Establishing a call to the base station (*MOC* state *Call Established, with option CMU-K39 only)*

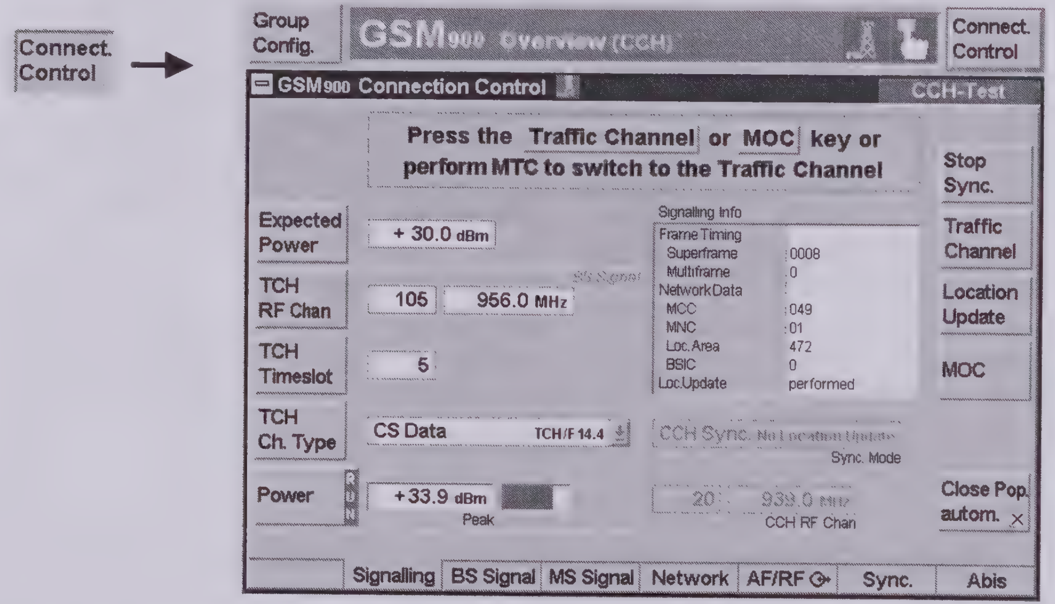
Note: *If the synchronization is lost during operation (because of a low signal level etc.) the warning Synchronization Lost ! will appear.*



Synchronization Lost

At the same time, bit 2 is set in the STATus:OPERation register. Prior to further operation, confirm the reception of the message by pressing the Accept button.

The *CCH Test* tab can not be accessed with wired synchronization.



Press the Traffic Channel or MOC key or perform MTC to switch to the Traffic Channel

Expected Power: + 30.0 dBm

TCH RF Chan: 105 956.0 MHz

TCH Timeslot: 5

TCH Ch. Type: CS Data TCH/F 14.4

Power: +33.9 dBm Peak

Signalling Info
Frame Timing
Superframe : 0008
Multiframe : 0
Network Data
MCC : 049
MNC : 01
Loc. Area 472
BSIC 0
Loc.Update performed

CCH Sync. No Location Update (Sync. Mode)

20 939.0 MHz CCH RF Chan

Fig. 4-39 Connection Control – Signalling (CCH Test)

The function of the softkeys in the left half of the menu and of the *Close Pop. autom.* softkey (which is analogous to the *Open Pop. autom.* softkey) is described in the section *Signalling Control (State Unsynchronized)* on page 4.64.

Signalling Info The table *Signalling Info* indicates parameters that are transferred by the base station over the control channel.

Frame Timing Number of superframes (containing 26 x 51 = 1326 TDMA frames) and multiframes (containing 51 TDMA frames for control channels) transmitted via the CCH. The numbers are output values which are continuously updated. The multiframe counter wraps around after each complete superframe (26 multiframes); the superframe conter after 2^{12} superframes.

Network Data

MCC	3-digit Mobile Country Code
MNC	2-digit Mobile Network Code
Loc. Area	3-digit Location Area Code of the base station
BSIC	6 bit Base Transceiver Station Identity Code = NCC (PLMN Color Code) + BCC (BTS Color Code)

Remote control `[SENSe:]INFO:...?`

Sync. Mode The *Sync. Mode* field indicates the current synchronization mode as set in the *Unsynchronized* state, see *Sync. Mode* softkey on page 4.67.

Remote control `CONFigure:SIGNalling:SMODe?`

CCH RF Chan. The *CCH RF Chan.* field indicates the current CCH channel number and corresponding radio frequency, see section *Synchronization* on page 4.66.

Remote control `CONFigure:BSSignal:CCH:CHANnel? <ChannelNumber>`

Stop Sync. The *Stop Sync.* softkey stops the synchronization process.

The CMU returns to the signalling state *Unsynchronized*.

Remote control `PROCedure:SIGNalling:ACTion SSTP`

Traffic Channel The softkey *Traffic Channel* switches over to the *TCH Test* tab.

In the *TCH Test*, the CMU performs measurements on the traffic channel, see section *Traffic Channel Test* on page 4.71.

Remote control `PROCedure:SIGNalling:ACTion TCH`

Location Update The softkey *Location Update* initiates a location update of the CMU to the base station.

The *Location Update* tab is called up, see section *Location Update* on page 4.97. This softkey is available with option CMU-K39 only.

Remote control `PROCedure:SIGNalling:ACTion LUP`

MOC The softkey *MOC* sets up a call from the CMU to the base station (Mobile Originated Call).

The *Call in progress* tab is called up, see section *Call in Progress* on page 4.99. This softkey is available with option CMU-K39 only.

Remote control `PROCedure:SIGNalling:ACTion MOC`

Traffic Channel Test

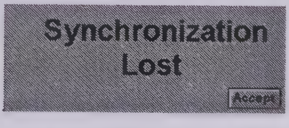
The *Signalling (TCH Test)* tab indicates and lets you modify:

- The maximum expected power from the DUT *(Expected Power)*, the channel *(TCH RF Channel)*, *Timeslot*, and *TCH Ch. Type* of the BTS traffic channel to be analyzed (panel *BTS Signal)*
- Status and result of wide-band peak-power measurement *(Power)*
- Besides, it provides information transmitted via the SACCH associated to the TCH *(Signalling Info)*, the *Sync. Mode* and the *CCH RF Channel*.

It contains softkeys which lead to other signalling states:

- Release of the synchronization *(Stop Sync. state Unsynchronized)*
- Switchover to control channel test *(Control Channel state CCH Test)*

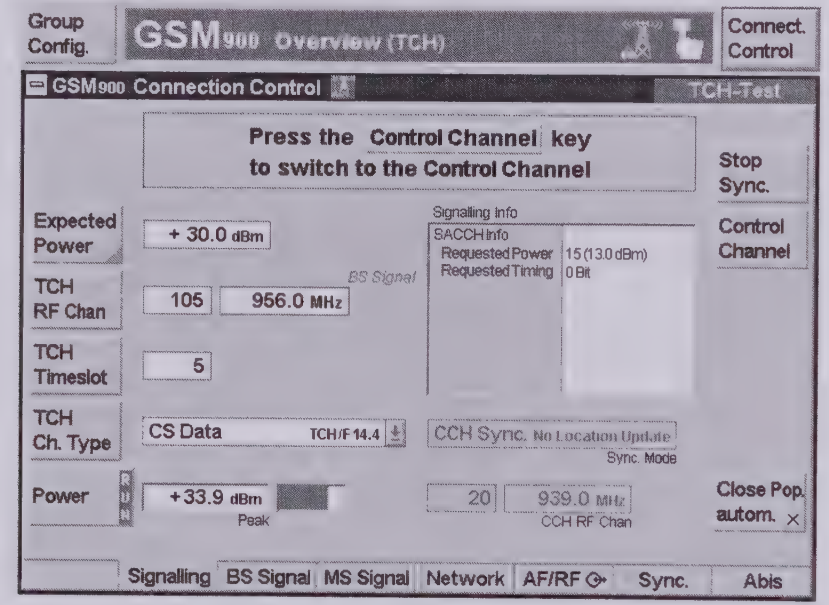
Note: *If the synchronization is lost during operation (because of a low signal level etc.) the warning Synchronization Lost ! will appear.*



Synchronization Lost

At the same time, bit 2 is set in the STATus:OPERation register. Prior to further operation, confirm the reception of the message by pressing the Accept button.

Connect. Control →



Group Config.
GSM900 Overview (TCH)
Connect. Control
GSM900 Connection Control
TCH-Test
Stop Sync.
Control Channel
Expected Power
TCH RF Chan
TCH Timeslot
TCH Ch. Type
Power
BS Signal
Close Pop. autom.
Signalling
BS Signal
MS Signal
Network
AF/RF
Sync.
Abis

Press the Control Channel key to switch to the Control Channel

Expected Power: + 30.0 dBm

TCH RF Chan: 105 956.0 MHz

TCH Timeslot: 5

TCH Ch. Type: CS Data TCH/F 14.4

Power: +33.9 dBm Peak

Signalling Info
SACCH Info
Requested Power 15 (13.0 dBm)
Requested Timing 0 Bit

Sync. Mode: CCH Sync. No Location Update

CCH RF Chan: 20 939.0 MHz

Fig. 4-40 Connection Control – Signalling (CCH Test)

The function of the softkeys in the left half of the menu and of the *Close Pop. autom.* softkey (which is analogous to the *Open Pop. autom.* softkey) is described in the section *Signalling Control (State Unsynchronized)* on page 4.64 ff.

Signalling Info The table *Signalling Info* indicates signalling information that is transferred by the base station via the SACCH (Slow Associated Control Channel) associated to the allocated traffic channel.

Requested Power	Power control level and (in brackets) corresponding maximum output power requested by the BTS from the mobile phone (CMU).
Requested Timing	Timing advance requested by the BTS.

The signalling info table is not available for wired synchronization because there no frame numbers are available.

Remote control

```
[SENSe:]INFO:SACChinfo:REQuested:POWer?
[SENSe:]INFO:SACChinfo:REQuested:TIMing?
```

Stop Sync.

The *Stop Sync.* softkey stops the synchronization process.

The CMU returns to the signalling state *Unsynchronized*.

Remote control `PROCedure:SIGNalling:ACTion SSTP`

Control Channel	The softkey *Control Channel* switches back to the *CCH Test* tab. This softkey is not available for wired synchronization; see Fig. 4-36 on page 4.64.
Remote control	`PROCedure:SIGNalling:ACTion CCH`

Overview

The main menu *Overview* provides an overview of the function group *GSM400/900/1800/1900-BTS Signalling*, the current measurement status and the most important scalar parameters and measurement results. From here (as from all other main menus), the configuration menus *Group Configuration* and *Connection Control* as well as all measurement menus are directly accessible.

Depending on the signalling state where measurements are performed and the channel type analyzed, there are different variants of the *Overview* menu:

Table 4-5 Overview menu in the different signalling states

Menu	**Channel**	**Signalling State**
Overview (CCH)	Control channel	CCH Test
Overview (TCH) (CCH Syncronization)	Traffic channel	TCH Test
Overview (TCH) (Wired Syncronization)	Traffic channel	TCH Test
Overview (TCH) (Call Established)	Traffic channel	Call Established

The main softkeys in the left softkey bar are equal for all three *Overview* menus; they start the corresponding measurement and inform on its current status (*RUN | HLT | OFF).* The meaning of the measurement results output is discussed under the measurement menus:

Panel *Power*	Burst power	*Power* menu, p. 4.76 ff
Panel *Modulation*	Modulation (phase and frequency error)	*Modulation* menu, p. 4.83 ff

Note that the results of the *Power* and *Modulation* measurements depend on the modulation scheme selected (GMSK or 8PSK modulation, if option CMU-K41 is available). This is analogous to the *Analyzer/Generator* menu in *Non Signalling* mode (see p. 4.2 ff).

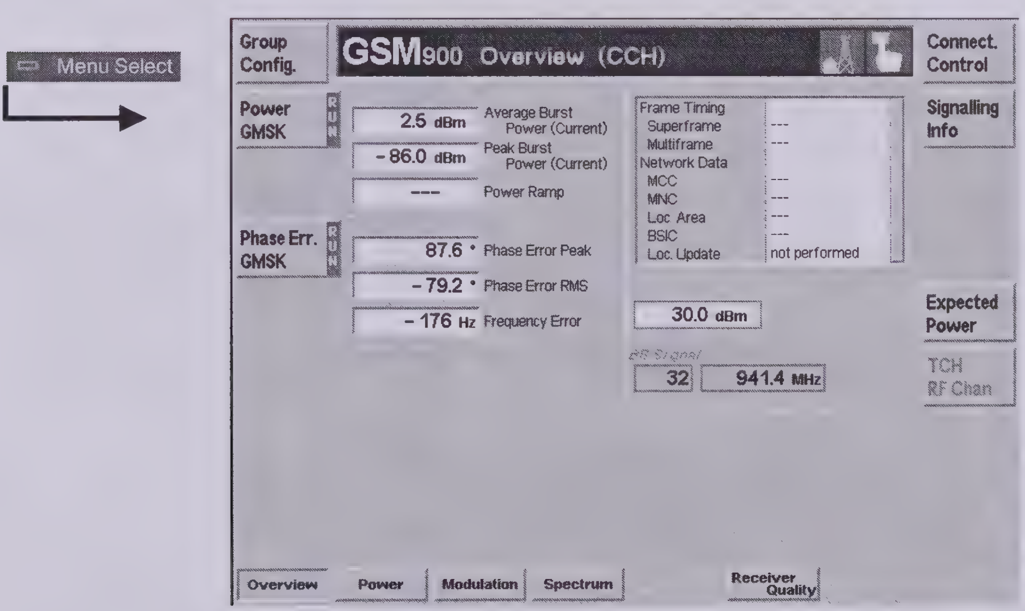
Whether and what kind of signalling and signal parameters can be set in the right half of the menu depends on the menu variant:

Table 4-6 Functionality of the Overview menu

Menu	**Channel**	**Description in Section**
Overview (CCH)	Panel *Signalling Info:* CCH signalling parameters	*Signalling (CCH Test),* p. 4.69 ff
	Expected Power softkey: Max. power of BTS signal	*Signalling (Unsynchronized),* p. 4.64 ff
	Channel and freq. of CCH (indicated)	*Signalling (Unsynchronized),* p. 4.64 ff
Overview (TCH) (CCH Synchronization)	Panel *Signalling Info:* SACCH info	*Signalling (TCH Test),* p. 4.71 ff
	Expected Power softkey: Max. power of BTS signal	*Signalling (Unsynchronized),* p. 4.64 ff
	TCH RF Chan. / TCH Timeslot / TCH Chan. Type (to be set) Traffic channel no., timeslot and data type of BTS signal	*Signalling (Unsynchronized),* p. 4.64 ff
	MS Signal RF level / Bit Stream Level and data type of MS (CMU) signal	*MS Signal (TCH Test),* p. 4.104 ff

Menu	**Channel**	**Description in Section**
Overview (TCH) (Wired Synchronization)	*Expected Power* softkey: Max. power of BTS signal	*Signalling (Unsynchronized)*, p. 4.64 ff
	TCH RF Chan. / TCH Timeslot / TCH Chan. Type (to be set) Traffic channel no., timeslot and data type of BTS signal	*Signalling (Unsynchronized)*, p. 4.64 ff
	MS Signal RF Level / Bit Stream Level and data type of MS (CMU) signal	*MS Signal (TCH Test)*, p. 4.104 ff
Overview (TCH) (Call Established)	Panel *Signalling Info:* SACCH info including dialed number	*Signalling (Call Established)*, p. 4.100 ff
	Expected Power softkey: Max. power of BTS signal	*Signalling (Unsynchronized)*, p. 4.64 ff
	TCH TS./ Chan Type (indicated) Traffic channel no. and timeslot	*Signalling (Unsynchronized)*, p. 4.64 ff
	MS Signal RF Level Level of signal transmitted by the CMU	*Signalling (Unsynchronized)*, p. 4.64 ff

The main menu *Overview* is opened from the main menu *Menu Select* (with associated key at the front of the instrument) and after closing the configuration menu *Connection Control - Signalling* (using the *Escape* key or automatically after reaching one of the signalling states listed in Table 4-5). It is linked with the measurement menus *Power, Modulation, Spectrum,* and *Receiver Quality* via the hotkeys.


Menu Select
GSM900 Overview (CCH)
Group Config.
Connect. Control
Power GMSK
RUN
Phase Err. GMSK
RUN
Signalling Info
Expected Power
TCH RF Chan
BS Signal
Overview
Power
Modulation
Spectrum
Receiver Quality

2.5 dBm Average Burst Power (Current)
- 86.0 dBm Peak Burst Power (Current)
--- Power Ramp
87.6 ° Phase Error Peak
- 79.2 ° Phase Error RMS
- 176 Hz Frequency Error

Frame Timing
Superframe ---
Multiframe ---
Network Data
MCC ---
MNC ---
Loc Area ---
BSIC ---
Loc. Update not performed

30.0 dBm
32 941.4 MHz

Fig. 4-41 Function overview – main menu Overview (TCH)

Power Measurements

The menu group *Power* contains the functions for measurement of the received signal power as a function of time (burst analysis). The popup menu *Power Configuration* is used for configuration of the measurements; the measurement results are displayed in the graphical measurement menu *Power*.

Most settings of this menu do not depend on the signalling state and correspond to those of the menu *Power* in the operating mode *GSM400/900/1800/1900-BTS Non Signalling* (for a detailed description see p. 4.6 ff). However, an additional application *P/Slot* is available in *Signallin*g mode.

The ***P/Slot*** application measures the average burst power in all eight timeslots of a TDMA frame. The average is taken over a section of the useful part of the burst; it is not correlated to the training sequence. The result is displayed in a bar graph (all eight timeslots of a single TDMA frame).

The *P/Slot* complements the *P/t* measurement where a large number of bursts can be measured but the output of the average burst power is restricted to current, average, minimum or maximum values within a statistics cycle (see *Display Mode* setting below). *P/Slot* returns **all** values; this application is suitable whenever the behavior or the stability of the average burst power in consecutive timeslots is to be monitored over an extended time range in R&D.

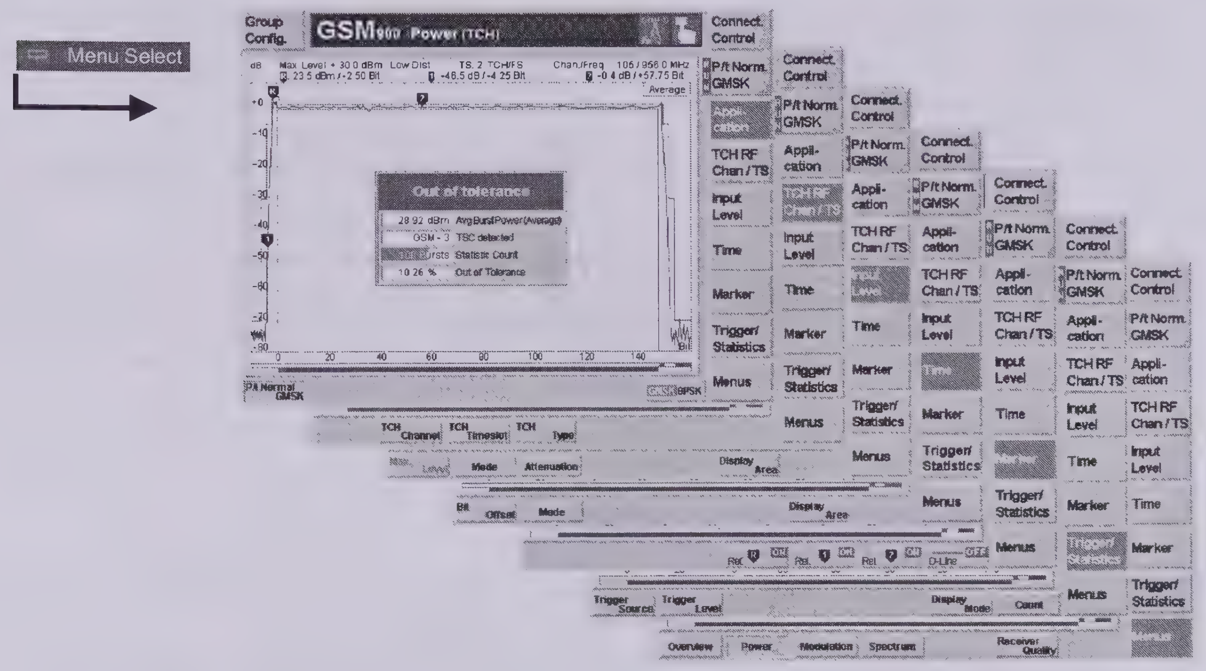
In all applications, the CMU measures at arbitrary RF input levels provided that they are within the allowed range of the RF input connectors.

Measurement Menu (Power)

The graphical measurement menu *Power* displays the results of the power measurement.

- The main softkey *P/t Norm. GMSK* (which changes to *P/Slot* or *P/t Norm. 8PSK,* depending on the power measurement application and on the modulation scheme selected) controls the power measurement, indicates its status *(RUN | HLT | OFF)* and opens the configuration menu *Power Configuration*.
- The other softkeys to the right of the test diagram are combined with various hotkeys (e.g. the *hotkeys Expected Power, Mode, Attenuation,* and *Display Area* are associated with the softkey *Input Level).* The softkey/hotkey combinations provide test settings and switch over between different measurements.

The measurement menu *Power* is opened from the main menu *Menu Select* (with the associated key at the front of the instrument) or using the hotkey *Power/t*.


Menu Select
Group Config.
GSM900 Power (TCH)
Connect. Control
P/t Norm. GMSK
Appli-cation
TCH RF Chan / TS
Input Level
Time
Marker
Trigger/ Statistics
Menus
P/t Normal GMSK
GMSK 8PSK
TCH Channel
TCH Timeslot
TCH Type
Max. Level
Mode
Attenuation
Display Area
Bit Offset
Mode
Ref.
Rel.
D-Line
OFF
Trigger Source
Trigger Level
Display Mode
Count
Overview
Power
Modulation
Spectrum
Receiver Quality

dB Max Level + 30.0 dBm Low Dist TS. 2 TCH/FS Chan./Freq 106 / 956.0 MHz
R 23.5 dBm / -2.50 Bit 1 -46.5 dB / -4.25 Bit 2 -0.4 dB / +57.75 Bit
Average

Out of tolerance
28.92 dBm AvgBurstPower(Average)
GSM - 3 TSC detected
Bursts Statistic Count
10.26 % Out of Tolerance

Fig. 4-42 Measurement menu Power – P/t Normal GMSK

Test Settings

The *P/t Norm. GMSK* main softkey (which changes to *P/Slot etc.,* depending on the power measurement application and modulation scheme selected) is analogous to the main softkey of the *Power* menu in *Non Signalling* mode. The same applies to the *Input Level, Time, Marker, and Trigger/Statistics* test settings and to the *Menus* softkey. For a detailed description of these functions refer to p. 4.6 ff.

Appli-cation

The *Application* softkey lets you select the power measurement application and the modulation scheme.

The application *P/t Normal <Mod_Type>* can be combined with any of the modulation schemes *GMSK* or *8PSK,* whereas the *P/Slot* application is available with GMSK modulation only. The *Power* measurement menu changes as a function of the application selected; the corresponding measurement results are explained in section *Measurement Results* on page 4.78 ff.

P/t Normal GMSK

The *P/t Normal <Mod_Type>* hotkey selects the power versus time measurement for normal burst signals. The hotkey labeling changes according to the modulation scheme *(GMSK* or *8PSK)* selected.

Remote control

The *P/t Normal GMSK* application is selected by the keywords `:NBURst:GMSK` in the 3rd and 4th level of the `POWer` commands, e.g. `CONFigure:POWer:NBURst:GMSK...`

The *P/t Normal 8PSK* application is selected by the keywords `:NBURst:EPSK` in the 3rd and 4th level of the `POWer` commands, e.g. `CONFigure:POWer:NBURst:EPSK...`

P/Slot

The *P/Slot* hotkey selects the power versus slot measurement.

In this application, the average burst power in all eight timeslots of a TDMA frame is measured and displayed in a bar graph (with GMSK modulation only).

Remote control

The *P/Slot* application is selected by the keyword `:SLOT` in the 3rd level of the `POWer` commands, e.g. `CONFigure:POWer:SLOT...`

GMSK 8PSK

The *GMSK 8PSK* softkey toggles between GMSK modulation and 8PSK modulation (option CMU-K41 required). The currently selected modulation scheme is marked in inverse video (white typeface on a dark background). Selecting a modulation scheme also changes the *P/t Norm. <Mod_Type>* hotkey and the *P/t Norm. <Mod_Type>* main softkey in the *Power* measurement menu.

Remote control

GMSK and 8PSK modulation is selected by the keywords `:GMSK` and `:EPSK` in the command headers, respectively.

The following test settings are available for all applications:

TCH RF Chan / TS

The *TCH RF Chan./TS* softkey defines the channel number, the timeslot and data type of the BTS traffic channel signal to be measured.

The three hotkeys *TCH Channel, TCH Timeslot,* and *TCH Type* associated to the *TCH RF Chan./TS* softkey correspond to the softkeys of the same name in the *Overview* menu and in the *Signalling* tab of the *Connection Control* menu, see section *Panel BTS Signal* on page 4.65. The *TCH RF Chan./TS* softkey is available in the signalling states *Unsynchronized* and *TCH Test* mode only; see Table 4-6 on page 4.74.

Remote control

`CONFigure:BSSignal:TCH...`

Trigger Statistics

The *Trigger/Statistics* softkey sets the trigger condition, the statistics mode and the number of statistic counts, see section *Trigger* on page 4.111 ff.

Difference from *Non Signalling* mode (p. 4.7 ff.):

In the mode *GSM400/900/1800/1900-BTS Signalling*, *Free Run*, *RF Power*, *IF Power*, and *Signalling* are available as trigger modes. This implies that the measurement is triggered by the signal from the base station or the signalling unit. Triggering by an additional external signal is not possible.

Measurement Results

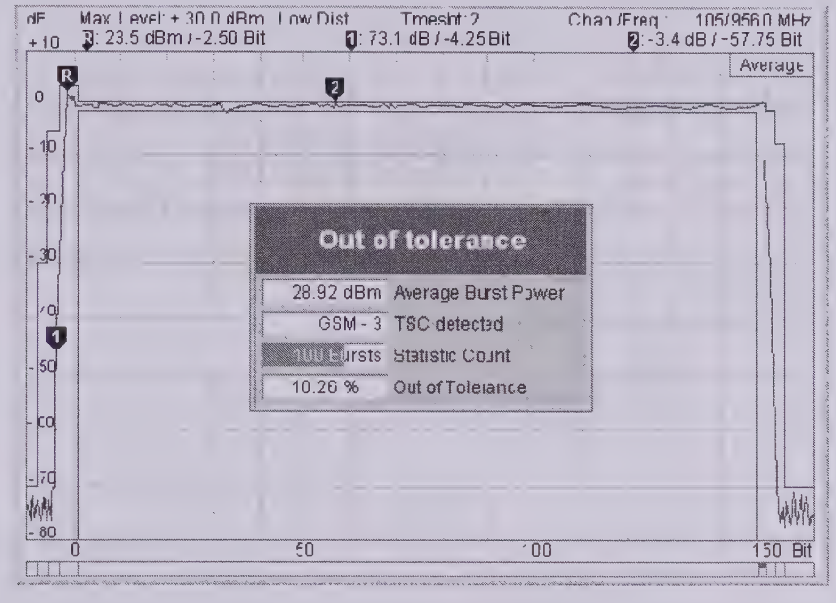
The measurement results depend on the application selected.

a) P/t Normal GMSK

The values represented in the measurement menu *Power*, application *P/t Normal GMSK,* can be divided into three groups:

- Settings
- Scalar measurement results (single values)
- Arrays (the measurement curve plotted as a function of time)

The measurement results are indicated in two parameter lines, the test diagram and an info box:



Parameter line 1 / 2

Test diagram

Info box

dF Max Level: + 30.0 dBm Low Dist Timeslot: 2 Chan./Freq: 105/956.0 MHz

R: 23.5 dBm / -2.50 Bit 1: 73.1 dB / -4.25 Bit 2: -3.4 dB / -57.75 Bit

Out of tolerance

28.92 dBm	Average Burst Power
GSM - 3	TSC detected
100 Bursts	Statistic Count
10.26 %	Out of Tolerance

Fig. 4-43 Display of results (Power – P/t Norm. GMSK)

Settings/ scalar results

Scalar measurement results and settings are indicated in the two parameter lines above the test diagram and in the info box, which is a popup window in the middle of the graphical screen *Power*.

1st parameter line

The first parameter line contains the following settings:

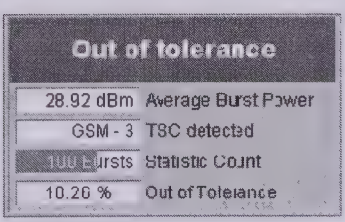
Expected Power	Maximum expected input power as set in *Input Power – Expected Power* (p. 4.111)
Attenuation	Setting for the attenuation of the input power *(Normal, Low Noise, Low Distortion)*
Timeslot	TCH timeslot number as set via the *TCH RF Chan./TCH TS* softkey or the *Connection Control* menu
Chan./Freq	RF channel and associated frequency

2nd parameter line

The second parameter line contains the following marker values:

R	Power and time of reference marker
1	Power and time of delta marker 1 (setting *absolute*) and/or difference from reference marker (setting *relative*)
2	Power and time of delta marker 2 (setting *absolute*) and/or difference from reference marker (setting *relative*)

Info-Box



Out of tolerance

28.92 dBm	Average Burst Power
GSM - 3	TSC detected
100 Bursts	Statistic Count
10.26 %	Out of Tolerance

The info box contains the following settings:

Statistic Count	Number of bursts per measurement cycle

In addition, it indicates the results for the scalar measured values:

Avg Burst Power	Average burst power, depending on the display mode set (see upper right corner of the diagram).
TSC detected	Training sequence of the measured signal
Out of Tolerance	Relative share of measured bursts that are out of the tolerances defined by the limit lines
Burst Matching	Error message if the displayed burst is out of tolerance. The message depends on the selected display mode

Remote control

Settings are read out using the query corresponding to the setting command (setting command with appended question mark).

For scalar measurement results:

```
READ[:SCALar]:POWer:NBURst:GMSK:CCH?
READ[:SCALar]:POWer:NBURst:GMSK:TCH?   etc.
CALCulate:POWer:NBURst:GMSK:CCH:MATChing:LIMit?
CALCulate:POWer:NBURst:GMSK:TCH:MATChing:LIMit?
```

Traces (arrays)

The measurement result is displayed as a continuous measurement curve in the test diagram together with the limit lines, markers and the D-line, if defined. The curve is derived from 668 equidistant measurement points with a ¼ bit spacing covering a time range between –10 bit and 156 ¾ bit.

The measurement curve in the *Power* measurement menu shows the measured burst power (in dB) as a function of time (in bits). The displayed result depends on the test settings. The display mode for the measurement curve *(Minimum, Maximum, Average, Current)* is indicated in the upper right corner of the diagram. The scale of both axes can be adjusted via the *Display Area* hotkey (see above).

If a traffic channel is measured (mode *TCH Test*), the carrier is typically off in the two timeslots before and after the measured burst. Both the rising and falling edge of the burst are visible.

Conversely, in the *CCH* analysis, timeslot 0 is measured and timeslot 1 may be occupied as well. In this scenario no limit lines are specified and the limit check is switched off for the falling edge of the burst.

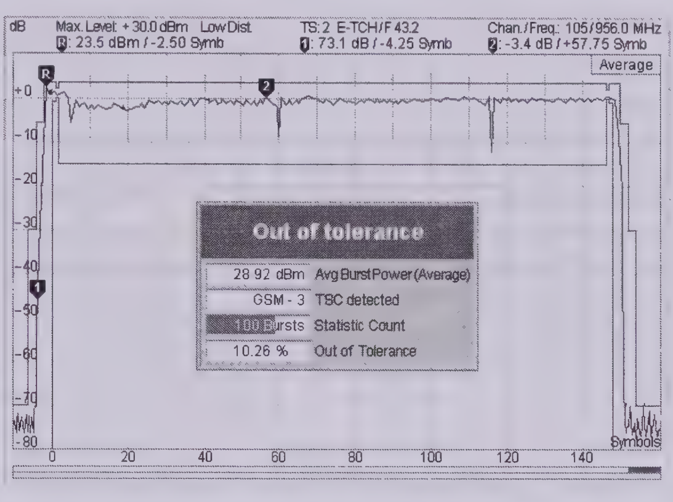
Remote control

```
READ:ARRay:POWer:NBURst:GMSK:CCH...
READ:ARRay:POWer:NBURst:GMSK:TCH...
```

b) P/t Normal 8PSK (Option CMU-K41 Required)

As shown in Fig. 4-44 below, the *P/t Normal 8PSK* measurement results are similar to the *P/t Normal GMSK* results. The differences are:

- With 8PSK modulation, the time axis is scaled in symbol periods. 8PSK symbol periods and GMSK bit periods are of equal length, see explanation of GSM burst structure at the beginning of section *Limit Lines* on page 4.18.
- The default limit lines differ from the GMSK limit lines.



Parameter line 1, 2

dB Max.Level: +30.0 dBm LowDist TS: 2 E-TCH/F 43.2 Chan./Freq.: 105/956.0 MHz
R: 23.5 dBm / -2.50 Symb 1: 73.1 dB / -4.25 Symb 2: -3.4 dB / +57.75 Symb

Average

Test diagram

Info box

Out of tolerance

28.92 dBm	Avg Burst Power (Average)
GSM - 3	TSC detected
100 Bursts	Statistic Count
10.26 %	Out of Tolerance

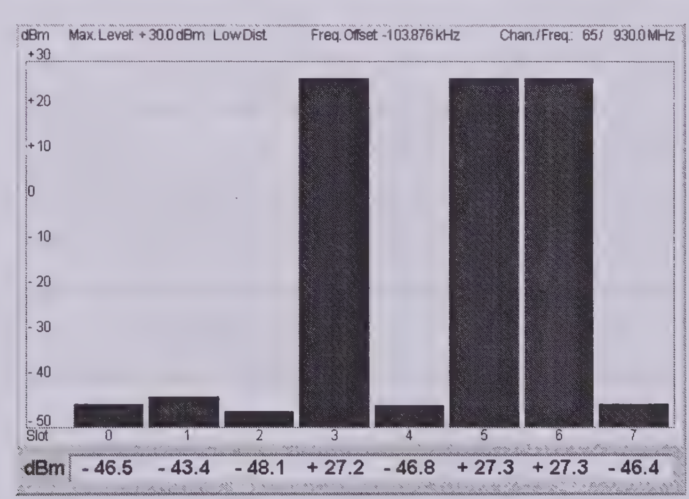
Fig. 4-44 Display of results (Power – P/t Norm. 8PSK)

c) P/Slot (GMSK Modulation only)

The results displayed in the measurement menu *Power*, application *P/Slot,* can be divided into two groups:

- Settings
- Measurement results, i.e. the average burst power in all eight slots of a TDMA frame

The measurement results are indicated in a parameter line, the test diagram and a table:



Parameter line

dBm Max.Level +30.0 dBm LowDist Freq. Offset -103.876 kHz Chan./Freq.: 65/ 930.0 MHz

Test diagram

Slot table

dBm	- 46.5	- 43.4	- 48.1	+ 27.2	- 46.8	+ 27.3	+ 27.3	- 46.4

Fig. 4-45 Display of results (Power – P/Slot)

Settings The essential settings are indicated in a parameter line above the test diagram. The line is identical to the first parameter line of the test diagram in the *P/t Normal GMSK* application.

Results The *P/Slot* application measures the average burst power in all eight time slots of a TDMA frame. The average is taken over a section of the useful part of the burst; it is not correlated to the training sequence. The time slots are numbered 0 to 7.

The eight values are shown in a bar graph and in a tabular overview below. No limit check is performed.

Remote control

```
READ[:SCALar]:POWer:SLOT:GMSK:TCH?
FETCh[:SCALar]:POWer:SLOT:GMSK:TCH?
SAMPle[:SCALar]:POWer:SLOT:GMSK:TCH?
```

Measurement Configurations (*Power* Configuration)

The popup menu *Power Configuration* contains three tabs which determine the parameters of the power measurement and provide graphical tools for evaluation of the measurement results.

The popup menu *Power Configuration* is activated by pressing the softkey *P/t Norm. GMSK* at the top right in the graphical measurement menu *Power* twice. It is possible to change between the tabs by pressing the associated hotkeys.

Measurement Control (Power Configuration – Control)

The tab *Control* controls the power measurement by determining

- The *Repetition* mode
- The *Stop Condition* for the measurement
- The averaging prescription to obtain the reference power *(Ref. Power Mode* , for *P/t Norm. 8PSK* measurements only)

Besides, it configures the diagram by adding or removing the *Grid*.

The functions of this menu are described in the section *GSM400/900/1800/1900-BTS Non Signalling* on page 4.15 ff.

Limit Lines (Power Configuration – Limit Lines)

The tab *Limit Lines* defines the limit lines for the burst analysis. Limit lines are a graphical tool for defining and monitoring tolerance values. The tab enables

- An overview of the default limit lines and areas *(Area Info)*
- Definition of the limit lines for the normal bursts section by section *(Upper Limit Line/Lower Limit Line)*

The functions of this menu are described in the section *GSM400/900/1800/1900-BTS Non Signalling* on page 4.18 ff.

Statistic Counts (Power Configuration – Statistics)

The tab *Statistics* defines the number of bursts/evaluation periods forming a statistics cycle *(Statistic Count)* and the power ramp displayed *(Display Mode)*.

The functions of this menu are described in the section *GSM400/900/1800/1900-BTS Non Signalling* on page 4.21 ff. For explanation of the settings see also chapter 3.

Modulation Measurements

The menu group *Modulation* contains the functions for measurement of the modulation parameters, i.e. the frequency and phase error in the burst and matching of the respective tolerance limits. The popup menu *Modulation Configuration* is used for configuration of the measurements; the measurement results are displayed in the graphical measurement menu *Modulation*.

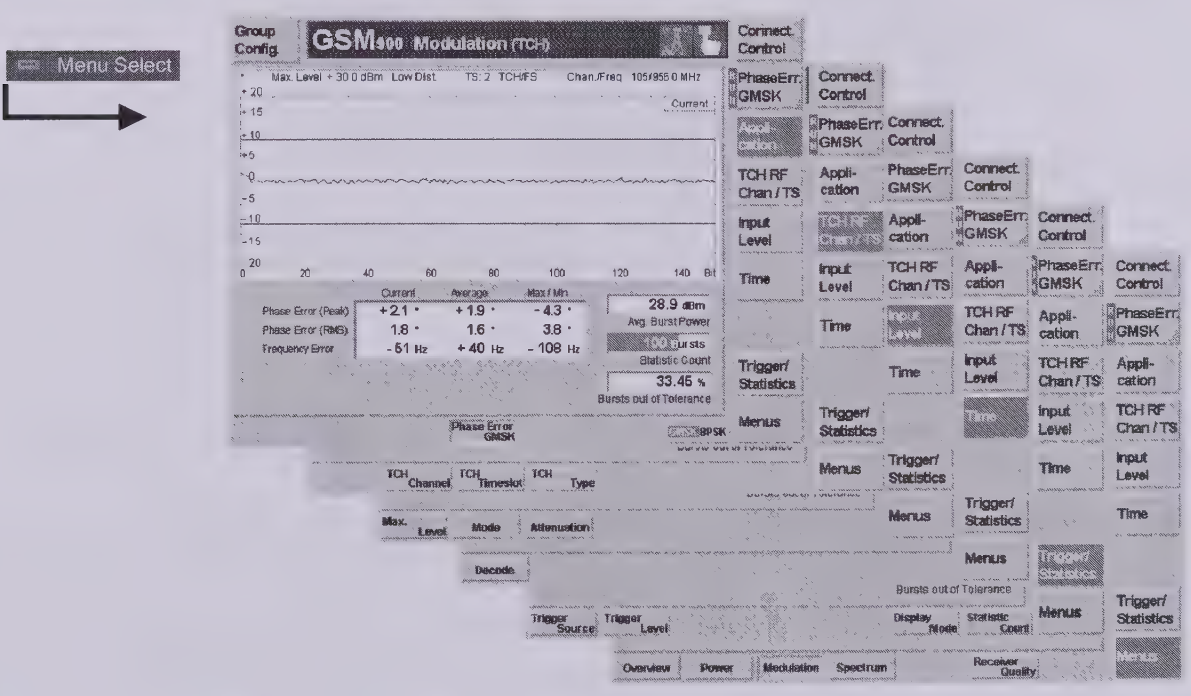
Apart from few exceptions (which also apply to the menu *Power*), the menu group *Modulation* does not differ from its corresponding menu group in the measurement mode *GSM400/900/1800/1900-BTS Non Signalling* (see p. 4.23 ff.):

1. The traffic channel, timeslot numbers, and the channel type of the BTS signal can be set via the *TCH RF Chan./TS softkey* in the *Modulation* menu, provided that the *TCH Test* mode is selected, i.e. that the measurement is performed on the BTS traffic channel.

   For CCH tests which are performed in timeslot 0; the traffic channel settings are not available.

2. In addition to the expected power, the attenuation, and the RF channel, the first parameter line also indicates the timeslot number of the base station signal.

3. Only *Free Run, RF Power* and *IF Power,* and *Signalling* are available as trigger setting. This implies that the measurement is triggered by the RF signal of the base station; triggering by an additional external signal (parameter *External*) is not possible.


Menu Select
Group Config.
GSM900 Modulation (TCH)
Connect. Control
Max. Level + 30.0 dBm Low Dist. TS: 2 TCH/FS Chan./Freq 105/956.0 MHz
Current
+20
+15
+10
+5
0
-5
-10
-15
20
0
20
40
60
80
100
120
140
Bit
PhaseErr. GMSK
Appli-cation
TCH RF Chan / TS
Input Level
Time
Trigger/ Statistics
Menus
Phase Error GMSK
8PSK
TCH Channel
TCH Timeslot
TCH Type
Max. Level
Mode
Attenuation
Decode
Trigger Source
Trigger Level
Display Mode
Statistic Count
Bursts out of Tolerance
Overview
Power
Modulation
Spectrum
Receiver Quality

	Current	Average	Max / Min
Phase Error (Peak)	+2.1 °	+1.9 °	-4.3 °
Phase Error (RMS)	1.8 °	1.6 °	3.8 °
Frequency Error	-51 Hz	+40 Hz	-108 Hz

28.9 dBm Avg. Burst Power

100 Bursts Statistic Count

33.45 % Bursts out of Tolerance

Fig. 4-46 Measurement menu Modulation – Phase Err. GMSK (TCH Test)

Test Settings

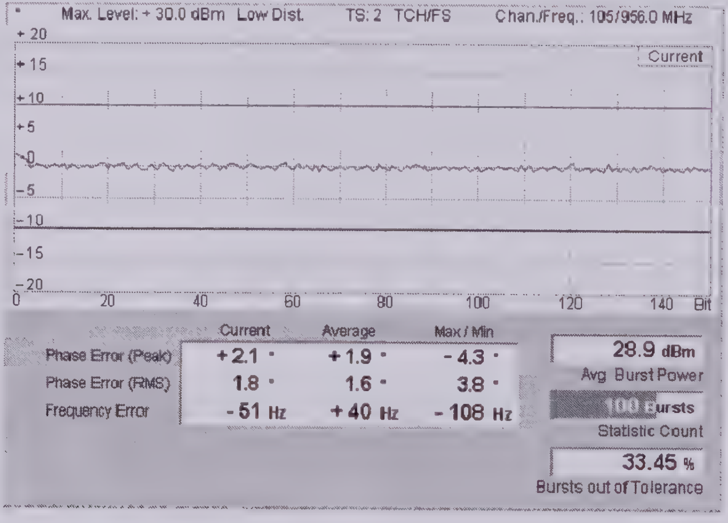
The selections and test settings provided by the *Input Level, Time,* and *Menus* softkeys are identical with those in the *Non Signalling* mode (see section *Test Settings* on page 4.24). The *TCH RF Chan./TS* and *Trigger/Statistics* softkeys are equal to the softkeys of the same name in the *Power* menu (see page 4.77).

Measurement Results

The values shown in the measurement menu *Modulation* can be divided into three groups:

- Setting values
- Scalar measurement results (single values)
- Arrays (the trace plotted as a function of time)

The values are indicated in two parameter lines, the test diagram and a tabular overview below:



Parameter line

Test diagram

Output table

Max. Level: + 30.0 dBm Low Dist. TS: 2 TCH/FS Chan./Freq.: 105/956.0 MHz

	Current	Average	Max / Min
Phase Error (Peak)	+ 2.1 °	+ 1.9 °	- 4.3 °
Phase Error (RMS)	1.8 °	1.6 °	3.8 °
Frequency Error	- 51 Hz	+ 40 Hz	- 108 Hz

Avg Burst Power: 28.9 dBm

Statistic Count: 100 Bursts

Bursts out of Tolerance: 33.45 %

Fig. 4-47 Display of results (modulation menu)

In contrast to the *Non Signalling* mode (see p. 4.25 ff.) the first parameter line contains also the timeslot of the base station signal. Besides the representation and interpretation of the results are identical.

Measurement Configurations (Modulation Configuration)

The popup menu *Modulation Configuration* contains three tabs which define the parameters of the phase and frequency error measurement including the error tolerances.

The popup menu *Modulation Configuration* is activated by pressing the softkey *Phase/Freq.* in the top right of the graphical measurement menu *Modulation* twice. By pressing the associated hotkeys, it is possible to change between the tabs.

The functions of the *Modulation Configuration* menus are described in section *GSM400/900/1800/1900-BTS Non Signalling*, see p. 4.33 ff.

Spectrum Measurements

The menu group *Spectrum* contains the functions for measurement of the off-carrier power, which is due to the modulation and the bursty nature of the RF signal. The popup menu *Spectrum Configuration* is used for configuration of the measurements; the measurement results are displayed in the graphical measurement menu *Spectrum*.

Apart from few exceptions (which also apply to the menu *Power*), the menu group *Spectrum* does not differ from the corresponding menu group in the measurement mode *GSM400/900/1800/1900-BTS Non Signalling* (see p. 4.38 ff.):

1. The traffic channel and timeslot numbers of the BTS signal can be set via the *TCH RF Chan./TS softkey* in the *Spectrum* menu, provided that the *TCH Test* mode is selected, i.e. that the measurement is performed on the BTS traffic channel.

   For *CCH* tests which are performed in timeslot 0; the traffic channel settings are not available.

2. In addition to the expected power, the attenuation, and the RF channel, the first parameter line also indicates the timeslot number of the base station signal.
3. Only *Free Run, RF Power* and *IF Power,* and *Signalling* are available as trigger setting. This implies that the measurement is triggered by the signal of the base station; triggering by an additional external signal (parameter *External*) is not possible.

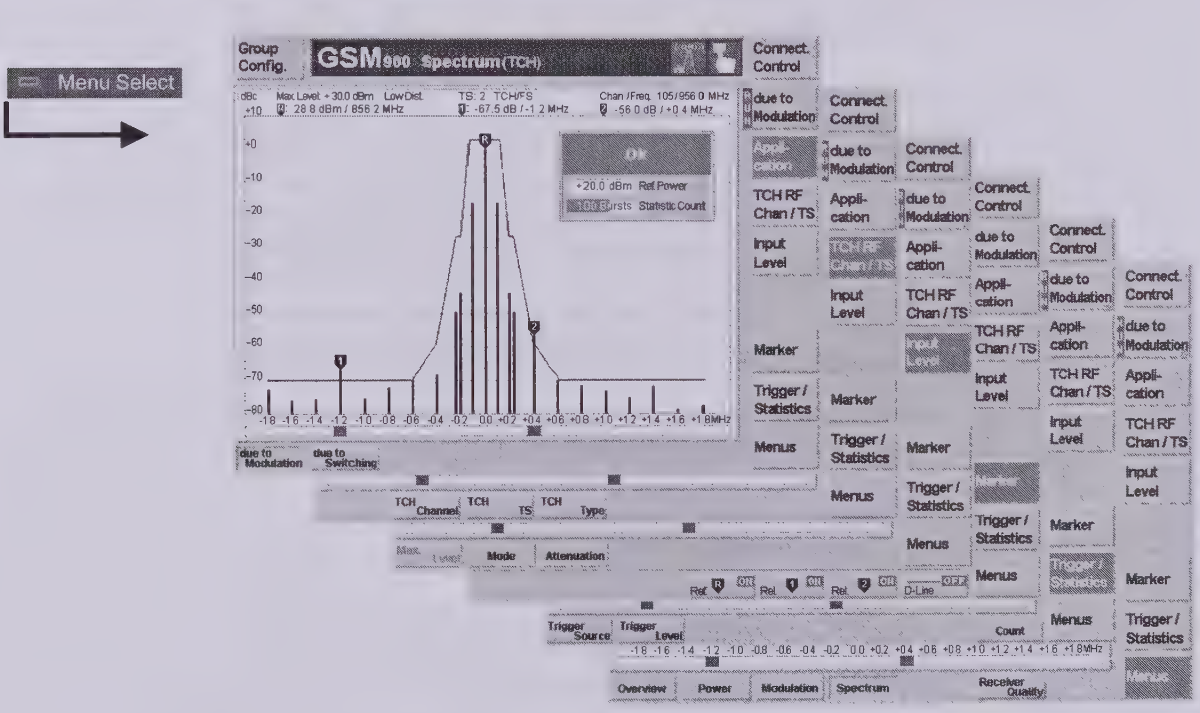

Menu Select
Group Config.
GSM900 Spectrum (TCH)
Connect. Control
due to Modulation
Appli-cation
TCH RF Chan / TS
Input Level
Marker
Trigger / Statistics
Menus
dBc
Max Level +30.0 dBm LowDist.
TS: 2 TCH/FS
Chan / Freq. 105 / 956.0 MHz
1: 28.8 dBm / 856.2 MHz
1: -67.5 dB / -1.2 MHz
2: -56.0 dB / +0.4 MHz
OK
+20.0 dBm Ref.Power
100 Bursts Statistic Count
+10
+0
-10
-20
-30
-40
-50
-60
-70
-80
-1.8 -1.6 -1.4 -1.2 -1.0 -0.8 -0.6 -0.4 -0.2 0.0 +0.2 +0.4 +0.6 +0.8 +1.0 +1.2 +1.4 +1.6 +1.8MHz
due to Modulation
due to Switching
TCH Channel
TCH TS
TCH Type
Max. Level
Mode
Attenuation
Ref. R
Rel. 1
Rel. 2
D-Line OFF
Trigger Source
Trigger Level
Count
Overview
Power
Modulation
Spectrum
Receiver Quality

Fig. 4-48 Measurement menu Spectrum (application due to Modulation)

Test Settings

The selections and test settings provided by the *Application, Input Level,* and *Menus* softkeys are identical with those in the *Non Signalling* mode (see section *Test Settings* on page 4.39). The *TCH RF Chan./TS* and *Trigger/Statistics* softkeys are equal to the softkeys of the same name in the *Power* menu (see page 4.77).

Measurement Results

The *Spectrum* measurement menu and the results depend on the type of spectrum (application) selected. The scaling of both axes is equal for the two spectra.

In contrast to the *Non Signalling* mode (see p. 4.40 ff.) the first parameter line also contains the timeslot of the base station signal. Besides the interpretation of the results is identical.

Measurement Configurations (Spectrum Configuration)

The popup menu *Spectrum Configuration* contains three tabs which define the parameters of the spectrum measurement including the error tolerances.

The popup menu *Spectrum Configuration* is called up by pressing the main softkey in the top right of the graphical measurement menu *Spectrum* twice (this softkey reads *Modulation GMSK/8PSK* or *Switching GMSK/8PSK*, depending on the selected application and modulation scheme). By pressing the associated hotkeys, it is possible to change between the tabs.

The functions of the *Spectrum Configuration* menu are described in section *GSM400/900/1800/1900-BTS Non Signalling*, see p. 4.43 ff.

Receiver Quality Measurements

The menu group *Receiver Quality* measures parameters which characterize the quality of transmission on the complete transmission path from the CMU to the device under test (base station) and back. In particular, assuming that transmitter errors do not occur, this allows to assess the sensitivity of the base station receiver at low RF power levels.

The popup menu *Receiver Quality Configuration* is used for configuration of the measurements; the measurement results are directly indicated in the main menu *Receiver Quality*.

Receiver Quality measurements are performed on the traffic channel with synchronization between the CMU and the base station (signalling state *TCH Test*). This is why they are not available in the mode *GSM400/900/1800/1900-BTS Non Signalling*.

Principle of the measurement

The sensitivity measurement is based on the comparison of the output signal sent by the CMU with the signal received and decoded by the device under test (base station).

To this end, the base station must be set to return the received signal to the CMU in loop back mode.

Because of the higher signal level, the transmission errors produced on the way back (from the base station to the CMU) can usually be neglected. However, frames destroyed on the way back are detected in a cyclic redundancy check (CRC) and counted. They are not taken into account in the calculation of transmission errors.

The quality of the base station transmitter can be tested separately in the *Power* and *Modulation* measurements.

Bit classes

In the GSM system, the speech coder combines the speech information into data blocks with a length of 260 bits, the so-called frames. Within one frame, the bits are divided into bit classes:

- The 78 *class II bits* have no error protection which is why they quickly produce transmission errors.
- The 132 *class Ib bits* are partly protected against errors during channel coding (by added guard bits).

The 50 most important *class Ia bits* are well protected. The base station itself recognizes erroneous class Ia bits and clears the complete frame if no correction is possible

Definition of measured quantities

The Bit Error Rate *(BER)* is the ratio of erroneous bits to the total number of transferred bits in percent. The CMU outputs the bit error rate according to bit classes:

BER II = Erroneous class II bits / total number of class II bits * 100%
BER Ib = Erroneous class Ib bits / total number of class Ib bits * 100%

The Frame Erasure Rate *(FER)* is the ratio of frames identified as erroneous to the total number of transferred frames in percent:

FER = Erroneous frames / total number of frames * 100%

The Residual Bit Error Rate *(Residual Bit Error Rate)* characterizes the quality of transmission of the valid frames (not erased, therefore residual). It corresponds to the ratio of the erroneous bits to the total number of transferred bits in percent, the numerator and denominator referring only to the **valid frames** *(residual frames, RF)*:

RBER II = Erroneous class II bits (RF) / total number of class II bits (RF) * 100%
RBER Ib = Erroneous class Ib bits (RF) / total number of class Ib bits (RF) * 100%

Burst by Burst mode (fast BER)

In the *Burst by Burst* mode, the CMU transmits only bits without error protection (class II bits); no guard bits are used. The signal loop in the BTS under test is closed before the channel coding and decoding stages (see Fig. 4-49), so raw bits are measured and the bit error rate is evaluated on a burst by burst basis. This increases the number of bits measured per unit of time and thus considerably enhances the measurement speed.

Note: *The* Burst by Burst *bit error rate test is specified for GSM phase II and phase II+ equipment. Not all base stations support this test mode. If a BTS does not support the* Burst by Burst *bit error rate test, the measurement fails (like for very low signal levels) and an error message*

Too many errors. Measurement halted !

is generated.

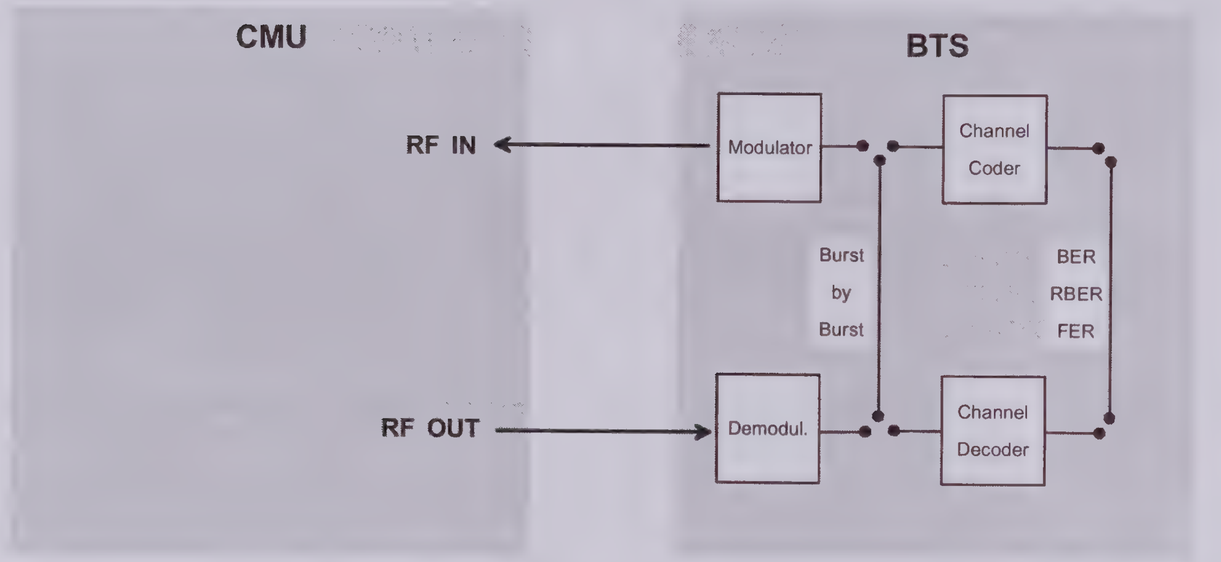


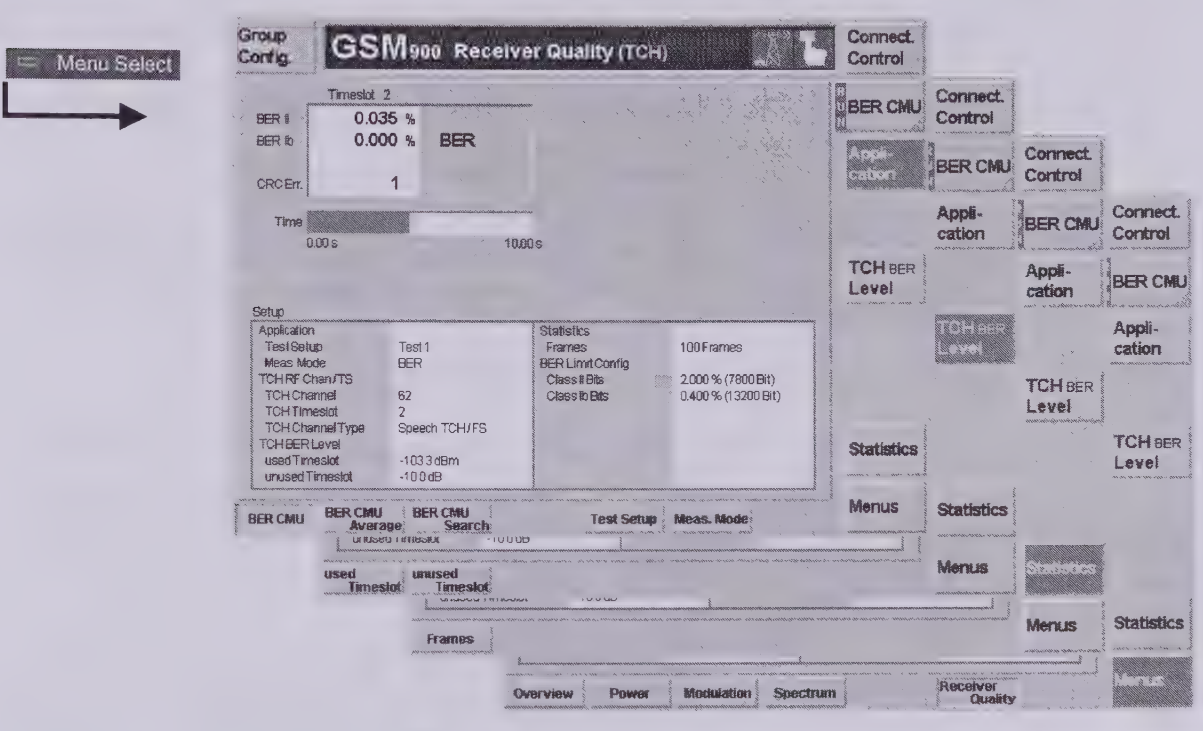
Fig. 4-49 Signal paths for BER and fast BER measurements

Main Menu (Receiver Quality)

The main menu *Receiver Quality* shows the results and the most important parameters of the *Receiver Quality* measurement.

- The main softkey *BER CMU* (which changes to *BER CMU Average* if the corresponding application is selected) indicates the status of the *Receiver Quality* measurement *(RUN | HLT | OFF)* and (if pressed twice) opens the configuration menu *Receiver Quality Configuration*.
- The softkeys *Application, TCH RF Chan./TS, TCH BER Level, and Statistics* to the right of the test diagram are combined with various hotkeys. If a softkey is selected and an associated hotkey pressed, a popup window will appear, which indicates a setting or enables an entry (see section *Test Settings* on page 4.7).
- The measurement results and a progress display are shown in the upper part of the *Receiver Quality* menu.
- The table *Test Setup* indicates the configuration settings for the current measurement.

The measurement menu *Receiver Quality* is opened from the main menu *Menu Select* (with the associated key at the front of the instrument) or from the menu group *GSM400/900/1800/1900-BTS Signalling* using the hotkey *Receiver Quality*.


Menu Select
Group Config.
GSM900 Receiver Quality (TCH)
Connect. Control
BER CMU
Appli-cation
TCH BER Level
Statistics
Menus
BER CMU
BER CMU Average
BER CMU Search
Test Setup
Meas. Mode
used Timeslot
unused Timeslot
Frames
Overview
Power
Modulation
Spectrum
Receiver Quality

Timeslot 2
BER II 0.035 %
BER Ib 0.000 % BER
CRC Err. 1
Time 0.00 s 10.00 s

Setup

Application		Statistics	
Test Setup	Test 1	Frames	100 Frames
Meas Mode	BER	BER Limit Config	
TCH RF Chan./TS		Class II Bits	2.000 % (7800 Bit)
TCH Channel	62	Class Ib Bits	0.400 % (13200 Bit)
TCH Timeslot	2		
TCH Channel Type	Speech TCH/FS		
TCH BER Level			
used Timeslot	-103.3 dBm		
unused Timeslot	-10.0 dB		

Fig. 4-50 Main menu Receiver Quality

Test Settings

The *TCH RF Chan./TS* and *Menu* settings are identical with those in the *Power* menu (see section *Test Settings* on page 4.77). The *Receiver Quality* measurement differs from the *Power* measurement in the softkeys *Application, TCH BER Level,* and *Statistics*. The trigger condition must be set in the *Group Configuration* menu (see p. 4.111).

Appli-cation

The *Application* softkey activates the selection of the application and the test setup.

The results for the three alternative applications are displayed in different measurement menus. When an application is selected, the corresponding measurement menu is called up. The configuration settings for all applications, however, are listed in a common popup-menu (see p. 4.93 ff).

BER CMU

The *BER CMU* hotkey selects a single shot *Receiver Quality* measurement.

The measurement is stopped after one statistics cycle, i.e. after the number of evaluation periods (frames) set in the configuration menu *Statistics* (see p. 4.96) or if a stop condition is met. A measurement that has been stopped is indicated by the status display *HLT* in the associated softkey.

Single shot should always be used if only a single measurement result is required under fixed conditions.

Remote control

No explicit switchover command. All single shot measurements are identified by the 2nd/3rd level keywords `...RXQuality:BER...`

BER CMU Average

The *BER CMU Average* hotkey selects a continuous *Receiver Quality*

The measurement runs until it is stopped explicitly, or until the stop condition is met. A continuous average over the selected number of evaluation periods (frames) is calculated. An ongoing measurement is indicated by the status display *RUN* in the associated softkey.

Remote control

No explicit switchover command. All single shot measurements are identified by the 2nd/3rd level keywords `...RXQuality:BAVerage...`

Test Setup

The *Test Setup* hotkey selects one of the 10 configurations that can be defined and stored for singe shot measurements. This hotkey is not available in the applications *BER CMU Average*. See section *Measurement Control (Receiver Quality Configuration – Control)* on page 4.93).

Remote control

```
CONFigure:RXQuality:BER:TSETup <TestSetup>
```

Meas. Mode

The *Meas. Mode* hotkey selects the measurement mode.

The measurement mode determines which quantities are measured and displayed in the upper table of the *Receiver Quality* menu. For a list of measurement modes and corresponding measurement results see section *Measurement Results* on page 4.91 ff.

Remote Control

```
CONFigure:RXQuality:BER<nr>:CONTrol <Mode>,<FramesToSend>
CONFigure:RXQuality:BAVerage:CONTrol <Mode>,<FrToAvg>
```

TCH BER Level

The *TCH Level* softkey defines the level in the used timeslot and in the unused timeslots of the CMU's traffic channel separately.

The definitions remain valid for the duration of the *Receiver Quality* measurement only, see section *Measurement Control (Receiver Quality Configuration – Control)* on page 4.93.

used Timeslot

The *Used Timeslot* hotkey defines the level in the used timeslot.

Remote control

```
CONFigure:RXQuality:BER<nr>:CONTrol:TCH:LEVel:UTIMeslot
CONFigure:RXQuality:BAVerage:CONTrol:TCH:LEVel:UTIMeslot
                <Level>
```

unused Timeslot

The *Unused Timeslot* hotkey defines the level in the unused timeslot.

The unused TS level is expressed in units relative to the level in the used timeslot. Note that the sensitivity specifications defined in GSM 11.21 must be met when the two timeslots adjacent to the used timeslot are detecting GSM signals at 50 dB above the used timeslot level. This is why the default value for the unused TS level is higher than the default used TS level.

Remote control

```
CONFigure:RXQuality:BER<nr>:CONTrol:TCH:LEVel:UNTimeslot
CONFigure:RXQuality:BAVerage:CONTrol:TCH:LEVel:UNTimeslot
                <Level>
```

Statistics/ Srch. Val.

The *Statistics* softkey defines the length of a statistics cycle. The settings *1* and *Off* (press *ON/OFF* key) are equivalent.

Frames

The *Frames* hotkey defines the number of frames which form a statistics cycle.

This hotkey is available in *BER CMU* mode (see *Application* softkey above) only. In this mode, the measurement extends over a statistics cycle if it is not stopped explicitly or by an error condition.

Remote control `CONFigure:RXQuality:BER<nr>:CONTrol <Mode>,<FrToSend>`

Average The *Average* hotkey defines the number of frames to be averaged.

This hotkey is available in *BER CMU Average* mode (see *Application* softkey above) only. In these modes, all average values are taken over the last n frames which form a statistics cycle (sliding averaging window).

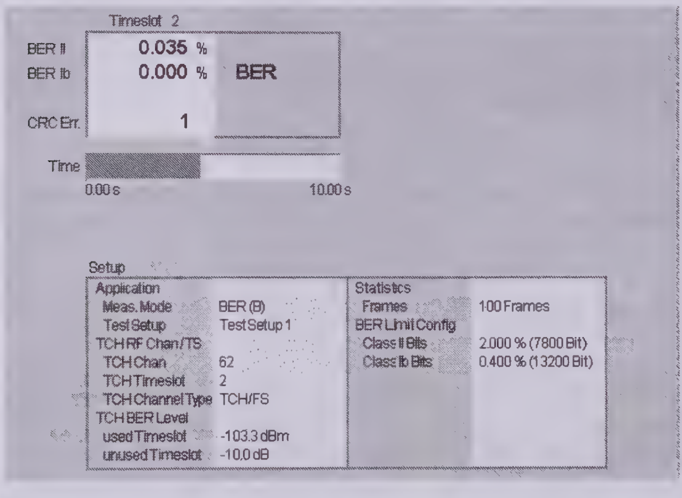
Remote control `CONFigure:RXQuality:BAVerage:CONTrol <Mode>,<FrToAvg>`

This hotkey is available in *RACH Test* mode (see *Application* softkey above) only.

Measurement Results

The values shown in the measurement menu *Receiver Quality* can be divided into two groups:

- Measurement results and the progress of the measurement are reported in the upper half of the menu
- The configurations of the current measurement are shown in the table below



```
        Timeslot  2
BER II       0.035 %
BER Ib       0.000 %    BER

CRC Err.         1

Time
        0.00 s                 10.00 s

        Setup
        Application                      Statistics
          Meas. Mode         BER (B)       Frames            100 Frames
          Test Setup         Test Setup 1  BER Limit Config
        TCH RF Chan/TS                       Class II Bits   2.000 % (7800 Bit)
          TCH Chan           62              Class Ib Bits   0.400 % (13200 Bit)
          TCH Timeslot       2
          TCH Channel Type   TCH/FS
        TCH BER Level
          used Timeslot      -103.3 dBm
          unused Timeslot    -10.0 dB
```

Fig. 4-51 Display of measurement results (Receiver Quality)

The measurement results in the left upper table to depend on the selected measurement mode (see definitions at the beginning of section *Receiver Quality Measurements* on page 4.87).

RBER/FER When the residual bit error rate *(Meas. Mode = RBER/FER)* is measured the following is displayed:

RBER II	Residual bit error rate for class II bits (unprotected bits)
RBER Ib	Residual bit error rate for class Ib bits (partly protected bits)
FER	Frame erasure rate: relative number of invalid and therefore erased frames
CRC Error	Result of *cyclic redundancy check.* Number of frames erased on the signal path from the device under test to the CMU

BER

When the bit error rate *(Meas. Mode = BER)* is measured the following is displayed:

BER II	Bit error rate for class II bits (unprotected bits)
BER Ib	Bit error rate for class Ib bits (partly protected bits)
CRC Error	Result of *cyclic redundancy check:* number of frames erased on the signal path from the device under test to the CMU

Burst by Burst

In a *Burst by Burst* mesurement (Fast BER, *Measurement Mode = Burst by Burst),* the following is displayed:

BER	Bit error rate for class II bits (unprotected bits, no other bits are transmitted)
CRC Error	Result of *cyclic redundancy check:* number of frames erased on the signal path from the device under test to the CMU

A *Time* progress bar below the table indicates the relative measurement progress:

- In a *single shot* measurement (Application *BER)*, the ratio between the current measurement time and the total measurement time which is indicated at the right end of the bar.
- In a *continuous* measurement (Application *BER CMU Average)*, the ratio between the frames measured and the total number of frames to be measured.

Remote Control

```
READ[:SCALar]:RXQuality:<Application>?
FETCh[:SCALar]:RXQuality:<Application>?
SAMPle[:SCALar]:RXQuality:<Application>?
```

Limit Check

A red background in the output field and an arrow pointing upwards indicates that the measurement result exceeds the upper limit set in the *Limits* tab of the *Receiver Quality Configuration* menu, see p. 4.95 ff.

Remote Control

```
CALCulate:RXQuality:<Application>:LIMit:MATChing?
```

Setup

The *Setup* table in the lower half of the *Receiver Quality* menu gives an overview of the configuration of the current *Receiver Quality* measurement. All parameters can be set via softkey/hotkey combinations (see p. 4.89 ff) or the configuration menus (see p. 4.93 ff) and are explained there in detail. Some of the parameters depend on the selected application and measurement mode:

Application	Measurement mode and name of the test setup selected (one out of max. 10, for single shot measurements (Application *BER)* only)
TCH RF Chan.	Channel and timeslot number of the traffic channel
TCH BER Level	Absolute signal level (in dBm) in the used timeslots and relative level in the unused timeslots at which the bit error rate is measured.
Statistics	Number of frames forming a statistics cycle.
BER Limit Config.	Upper limits for the measured bit error rates, residual bit error rates, or frame erasure rate

Remote control

See section *Measurement Configurations (Receiver Quality Configuration)* below.

Measurement Configurations (*Receiver Quality Configuration*)

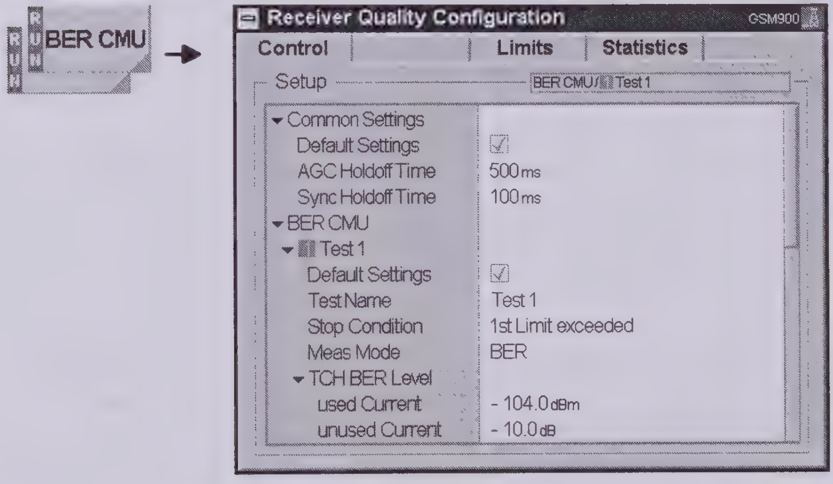
The popup menu *Receiver Quality Configuration* contains three tabs which determine the parameters for measurement of the bit error rate.

The popup menu *Receiver Quality Configuration* is activated by pressing the softkey *BER CMU* at the top right in the main menu *Receiver Quality* twice (this softkey reads *BER CMU*, *BER CMU Average*, depending on the selected application). It is possible to change between the tabs by pressing the associated hotkeys.

Measurement Control (*Receiver Quality Configuration* – Control)

The tab *Control* controls the *Receiver Quality* measurement by determining

- *Holdoff Times* for automatic gain control and synchronization
- For single shot (Application *BER CMU)* and continuous (Application *BER CMU Average)* measurements, the *Stop Condition,* the *Meas. Mode*, and the signal level at which the bit error rate is measured *(TCH BER Level)*. In the single shot mode these parameters can be entered and stored independently for up to 10 test setups.



Setup: BER CMU/Test 1

Common Settings	
Default Settings	☑
AGC Holdoff Time	500 ms
Sync Holdoff Time	100 ms
BER CMU	
Test 1	
Default Settings	☑
Test Name	Test 1
Stop Condition	1st Limit exceeded
Meas Mode	BER
TCH BER Level	
used Current	- 104.0 dBm
unused Current	- 10.0 dB

Fig. 4-52 Receiver Quality – Control

Default Settings The first *Default* switch overwrites all settings in the *Control* tab with default values. Besides, there are default switches acting on every individual *BER CMU* test setup, and on the *BER CMU Average* mode.

Remote control

```
DEFault:RXQuality:BER<nr>:CONTrol  ON | OFF
DEFault:RXQuality:BAVerage:CONTrol  ON | OFF
```

Common Settings The *Holdoff times* necessary for the adjustment of the base station to the *Receiver Quality* measurement and the loop-back of the bit stream are shared by all applications:

AGC Holdoff Time	Time during which the base station can adjust itself to the new RF level at the beginning of the receiver quality measurement *(automatic gain control).* The *AGC Holdoff Time* is also applied if the RF level changes during the receiver quality measurement.
Sync. Holdoff Time	Delay time after which the signalling unit of the CMU starts synchronizing to the bit stream. This holdoff time is not applied in the case of RF level changes during the receiver

quality measurement.

Both hold off times depend on the performance of the base station. A reduction of the hold off times towards their BTS-dependent lower limits can accelerate the measurement.

Remote control

```
CONFigure:RXQuality:CONTrol:HTIMe <AGCTime>,<SynchTime>
```

BER CMU Test Setup

The *Test Setup* table section defines up to 10 user-specific configuration files for single shot sensitivity measurements. The applications are numbered from 1 to 10 and can be called up via the *Test Setup* hotkey associated to the *Application* softkey. They differ from each other in the default settings for the signal power of the CMU and the criteria for analysis.

Remote control

```
CONFigure:RXQuality:BER:TSETup <Testsetup>
```

Test Name

The *Test Name* parameters assign a name to each of the 10 test setups (application *CMU BER* only). In the *Test Setup* hotkey, the individual test setups are referenced with their *Test Name*.

Remote control –

Stop Condition

The *Stop Condition* parameter defines a stop condition for the (single shot or continuous) measurement:

NONE	Continue measurement even in case of error
1st Limit exceeded	Stop measurement on first error (tolerance exceeded)
All Limits exceeded	Stop measurement if all tolerances are exceeded

Remote control

```
CONFigure:RXQuality:<Application>:CONTrol:REPetition
        ALIMits | FLIMit | NONE,<StepMode>
```

Meas. Mode

The *Meas. Mode* parameter determines which quantities are measured and displayed in the upper table of the *Receiver Quality* menu (not for RACH Test).

RBER/FER	Residual bit error rate (separately for class II and class Ib bits) and frame erasure rate
BER	Bit error rate (separately for class II and class Ib bits)
Burst by Burst	Accelerated measurement, only class II bits are transmitted

All measured quantities are defined at the beginning of the section *Receiver Quality* on page 4.87.

Remote control

```
CONFigure:RXQuality:BER<nr>:CONTrol
        RFER | BER | BBB,<FramesToSend>
CONFigure:RXQuality:BAVerage:CONTrol
        RFER | BER | BBB,<FramesToAverage>
```

TCH BER Level

The *TCH BER Level* parameter defines the level in the traffic channel by means of the following specifications (single or continuous measurements):

used Current	Absolute level in the used timeslot of the traffic channel, valid during the Receiver Quality measurement only,
unused Current	Level in the unused timeslots of the traffic channel relative to the level in the used timeslot.

The level in the used timeslot is specified in dBm. The permissible value range depends on the selected RF output of the CMU and the external attenuation set.

The level in the unused timeslots is specified relative to the level in the used timeslot in the unit dB.

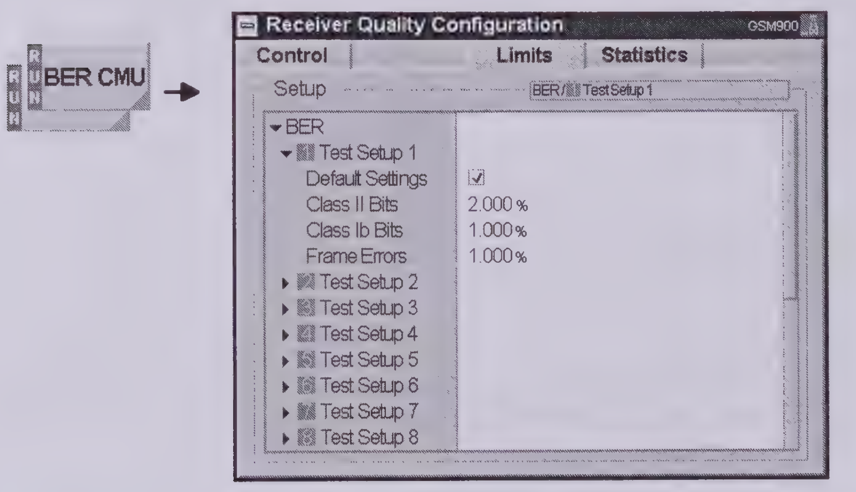
The actual level in the unused timeslots must also lie within the permissible range for the RF outputs. This condition may place an additional restriction on the permissible maximum level for the unused timeslots.

Remote control

```
CONFigure:RXQuality:<Application>:CONTrol:TCH:
        LEVel:UTIMeslot <Level>
CONFigure:RXQuality:<Application>:CONTrol:TCH:
        LEVel:UNTimeslot <Level>
```

Upper Limits for Bit Error Rate (*Receiver Quality Configuration* – Limits)

The *Limits* tab defines an upper pass/fail limit for the individual measured quantities in the sensitivity menu. This is done separately for the max. 10 single shot test setups and for the *BER CMU Average* mode.



Default Settings	☑
Class II Bits	2.000 %
Class Ib Bits	1.000 %
Frame Errors	1.000 %

Fig. 4-53 Receiver Quality Configuration – Limits

Default Settings The *Default Settings* switch applies default values to all parameters concerning the corresponding table range or BER application.

Remote control `DEFault:RXQuality:BER<nr>|BAVerage:LIMit ON | OFF`

Test Setup 1 etc. The upper limits for the measured quantities can be set independently for each single shot test setup and for continuous measurements. The measured quantities are defined at the beginning of section *Receiver Quality* on page 4.87; they are selected via the *Meas. Mode (*bit error rates in mode *BER,* residual bit error rates and frame erasure rate in mode *RBER/FER).*

Class II Bits	Upper limit of (residual) bit error rate for class II bits (unprotected bits) in the value range 0% ... 100%.
Class Ib Bits	Upper limit of (residual) bit error rate for class Ib bits (partly protected bits) in the value range 0% ... 100%.
Frame Errors	Upper limit for frame erasure rate, relative number of invalid and therefore erased frames in the value range 0% ... 100%.

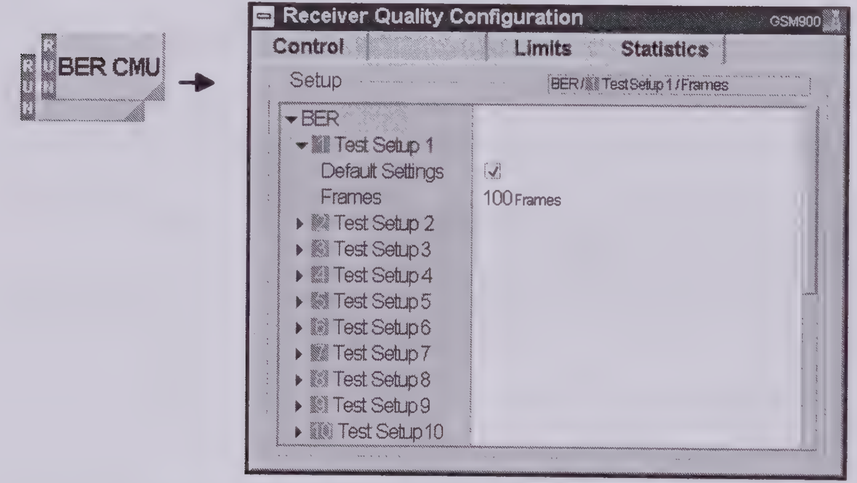
The default settings for the three upper limits reflect the importance of the three

	measured quantities for evaluation of the transmission and received-signal quality (in the case of unprotected bits, a higher error rate is expected and accepted than in the case of protected bits, etc.).

Remote control	`CONFigure:RXQuality:<Application>:LIMit:CLII <Error>`
	`CONFigure:RXQuality:<Application>:LIMit:CLIB <Error>`
	`CONFigure:RXQuality:<Application>:LIMit:FERRors <Error>`

Scope of Measurement (Receiver Quality Configuration – Statistics)

The *Statistics* tab determines the scope of measurement, i.e. the number of frames to be sent or averaged in the BER test.



Setup BER / Test Setup 1 / Frames

- BER
  - Test Setup 1
    - Default Settings ☑
    - Frames 100 Frames
  - Test Setup 2
  - Test Setup 3
  - Test Setup 4
  - Test Setup 5
  - Test Setup 6
  - Test Setup 7
  - Test Setup 8
  - Test Setup 9
  - Test Setup 10

Fig. 4-54 Receiver Quality Configuration – Statistics

Default Settings	The *Default Settings* switch applies default values to all parameters concerning the corresponding table range or BER application.
Remote control	`DEFault:RXQuality:BER<nr>|BAVerage:CONTrol ON	OFF`
Frames	The parameter *Frames* defines the statistic count (= the number of frames to be sent in a single shot measurement). A low value permits to limit the scope of measurement and accelerate the measurement. The default setting depends on the test setup.
Remote control	`CONFigure:RXQuality:BER<nr>:CONTrol <Mode>,<FramesToSend>`
Average	The parameter *Average* defines the number of frames to be averaged in a *BER CMU Average* measurement.
Remote control	`CONFigure:RXQuality:BAVerage:CONTrol <Mode>,<FramesToAverage>`

Popup Menu Connection Control

The menu group *Connection Control* controls the signalling procedures (synchronization, call setup and release, services, signalling parameters) and determines the inputs and outputs with the external attenuation values and the reference frequency.

As most *Signalling* measurements are performed in the *CCH Test* or *TCH Test* state or with an existing call connection to the BTS *(Call Established),* the *Signalling* menus (*Connection Control – Signalling)* are opened immediately after selection of the function group *GSM400/900/1800/1900-BTS Signalling* in the *Menu Select* menu. Besides, all the menus of the *Connection Control* group can be accessed any time by pressing the softkey *Connect. Control* at the top right in every measurement menu. They are linked with each other via the hotkey bar at the lower edge of the screen. By pressing the *Escape* key, the active *Connection Control* menu is closed and the CMU changes to the measurement mode.

The tabs *Connection Control – Signalling* displayed during synchronization are described at the beginning of section *GSM Measurements with Signalling* on p. 4.64 ff. The remaining tabs of the *Connection Control* menu are described below.

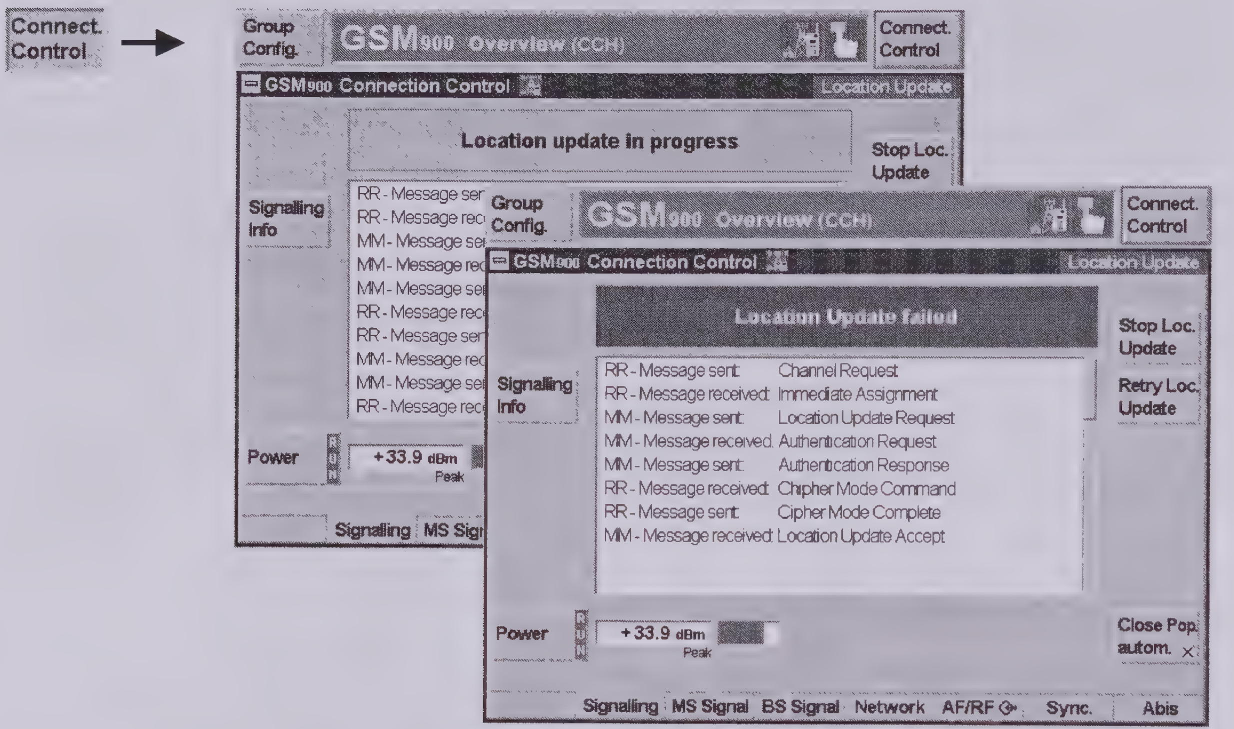
Location Update (with Option CMU-K39 only)

The *Signalling (Location Update)* tab provides information on

- The signalling state Location Update in Progress or Location Update Failed (header message)
- The progress of the location update (Signalling Info)
- The status and result of the peak power measurement (Power)

Besides, it contains a softkey which stops the location update procedure *(Stop Loc. Update)*. If location update fails, an additional softkey *(Retry Loc. Update)* allows to re-initiate a location update.

A location update is always initiated from the CMU while it is in the signalling state *CCH Test*. The *Location Update* tab is thus opened via the *Location Update* softkey in the *Signalling (CCH Test)* tab. It is closed automatically after a successful location update or by pressing the *ESCAPE* key or the *Connection Control* softkey. The *Signalling Info* table in the *Signalling (CCH Test)* tab indicates whether or not a location update was performed in the current measurement session.


Connect. Control
Group Config.
GSM900 Overview (CCH)
Connect. Control
GSM900 Connection Control
Location Update
Location update in progress
Stop Loc. Update
Signalling Info
Power
+33.9 dBm
Peak
Signalling
MS Sign
Location Update failed
Retry Loc. Update
Close Pop. autom.
MS Signal
BS Signal
Network
AF/RF
Sync.
Abis

RR - Message sent: Channel Request
RR - Message received: Immediate Assignment
MM - Message sent: Location Update Request
MM - Message received: Authentication Request
MM - Message sent: Authentication Response
RR - Message received: Chipher Mode Command
RR - Message sent: Cipher Mode Complete
MM - Message received: Location Update Accept

Fig. 4-43 Connection Control – Signalling (Location Update)

The function of the softkey *Power* and of the *Close Pop. autom.* softkey (which is analogous to the *Open Pop. autom.* softkey) is described in the section *Signalling Control without Signal* on page 4.66.

Header Message The header message indicates whether the CMU is in the signalling state *Location Update in Progress* or *Location Update Failed*. In the signalling state *Location Update Failed*, an additional softkey *(Retry Loc. Update)* allows to re-initiate a location update.

Signalling Info

The *Signalling Info* softkey activates the output table (for scrolling etc.).

In the output window, all Radio Resources *(RR)* and Mobility Management *(MM)* procedures, i.e. all RR and MM messages sent and received by the CMU, are displayed.

Remote control –

Stop Loc. Update

The *Stop Loc. Update* softkey stops the location update process.

The CMU returns to the signalling state *Unsynchronized.*

Remote control `PROCedure:SIGNalling:ACTion SLUP`

Retry Loc. Update

The *Retry Loc. Update* softkey initiates a new location update.

This softkey is available in the *Location Update Failed* state only. The CMU changes to the signalling state *Location Update in Progress.*

Remote control `PROCedure:SIGNalling:ACTion RLUP`

Call in Progress (with Option CMU-K39 only)

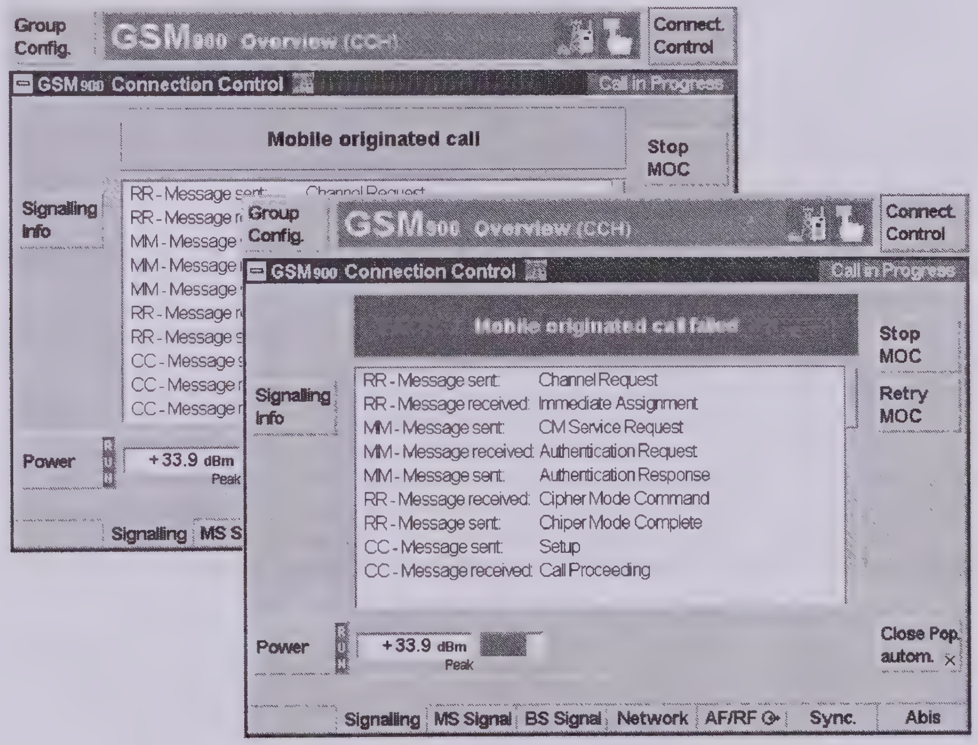
The *Signalling (Call in Progress)* tab provides information on

- The signalling state *MTC/MOC in Progress* or *MTC/MOC Failed* (header message)
- The progress of the call setup *(Signalling Info)*
- The status and result of the peak power measurement *(Power)*

Besides, it contains a softkey which stops the call setup procedure *(Stop MTC/MOC)*. If the call fails, an additional softkey *(Retry MTC/MOC)* allows to re-initiate a call setup.

In the *CCH Test* signalling state, a call can be set up from either the CMU/mobile station *(Mobile Originated Call, MOC)* or from the base station *(Mobile Terminated Call, MTC)*. The *Call in Progress* tab is thus opened via the *MOC* softkey in the *Signalling (CCH Test)* tab or automatically as soon as the CMU receives a call from the base station. It is closed automatically after successful call setup or by pressing the *ESCAPE* key or the *Connection Control* softkey. After a successful call setup, the CMU changes to the signalling state *Call Established*.

Connect. Control →


Group Config.
GSM900 Overview (CCH)
Connect. Control
GSM900 Connection Control
Call in Progress
Mobile originated call
Stop MOC
Signalling Info
Power
+33.9 dBm
Peak
Mobile originated call failed
Retry MOC
Close Pop. autom.
Signalling
MS Signal
BS Signal
Network
AF/RF
Sync.
Abis

RR - Message sent:	Channel Request
RR - Message received:	Immediate Assignment
MM - Message sent:	CM Service Request
MM - Message received:	Authentication Request
MM - Message sent:	Authentication Response
RR - Message received:	Cipher Mode Command
RR - Message sent:	Chiper Mode Complete
CC - Message sent:	Setup
CC - Message received:	Call Proceeding

Fig. 4-44 Connection Control – Signalling (Call in Progress)

The function of the softkey *Power* and of the *Close Pop. autom.* softkey (which is analogous to the *Open Pop. autom.* softkey) is described in the section *Signalling Control without Signal* on page 4.66.

Header Message The header message indicates whether the CMU is in the signalling state *Call in Progress* or *Call Failed*, where a call can be initiated by either the CMU (MOC) or the base station (MTC). In the signalling state *Call Failed*, an additional softkey *(Retry MTC/MOC)* allows to re-initiate a call setup.

Signalling Info

The *Signalling Info* softkey activates the output table (for scrolling etc.).

In the output window, all Radio Resources *(RR)*, Mobility Management *(MM)*, and

Call Control *(CC)* procedures, i.e. all RR, MM, and CC messages sent and received by the CMU, are displayed.

Remote control –

Stop MOC

The *Stop MOC* softkey stops the call process.

The CMU returns to the signalling state *Unsynchronized.*

Remote control `PROCedure:SIGNalling:ACTion SMOC`

Retry MOC

The *Retry MOC/Retry MTC* softkey initiates a new call.

This softkey is available in the *Call Failed* state only. The CMU changes to the signalling state *Call in Progress.*

Remote control `PROCedure:SIGNalling:ACTion RMOC`

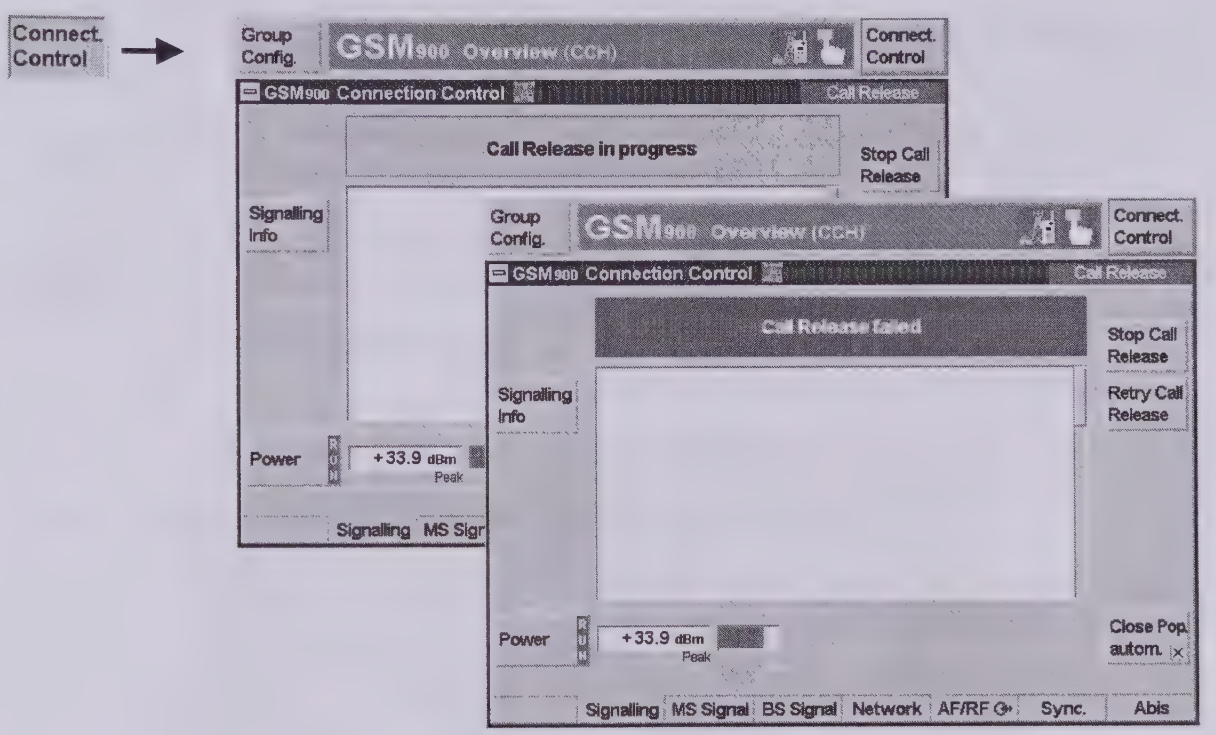
Call Release (with Option CMU-K39 only)

The *Signalling (Call Release)* tab provides information on

- The signalling state *Call Release in Progress* or *Call Release Failed* (header message)
- The progress of the call release *(Signalling Info)*
- The status and result of the peak power measurement *(Power)*

Besides, it contains a softkey which stops the call release procedure *(Stop Call Release).* If the call release fails, an additional softkey *(Retry Call Release)* allows to re-initiate a call release.

An established call can be released by either CMU/mobile station while it is in the signalling state *Call Established* or by the base station. The *Call in Progress* tab is thus opened via the *Call Release* softkey in the *Signalling (Call Established)* tab or automatically as soon as the base station releases the call. It is closed automatically after successful call release or by pressing the *ESCAPE* key or the *Connection Control* softkey. After a successful call release, the CMU changes to the signalling state *CCH Test.*


Connect. Control
Group Config.
GSM900 Overview (CCH)
Connect. Control
GSM900 Connection Control
Call Release
Stop Call Release
Signalling Info
Power
Signalling
MS Sign
Group Config.
GSM900 Overview (CCH)
Connect. Control
GSM900 Connection Control
Call Release
Stop Call Release
Retry Call Release
Signalling Info
Power
Close Pop. autom.
Signalling
MS Signal
BS Signal
Network
AF/RF
Sync.
Abis

Call Release in progress

Power +33.9 dBm Peak

Call Release failed

Power +33.9 dBm Peak

Fig. 4-45 Connection Control – Signalling (Call Release)

The function of the softkey *Power* and of the *Close Pop. autom.* softkey (which is analogous to the *Open Pop. autom.* softkey) is described in the section *Signalling Control without Signal* on page 4.66.

Header Message The header message indicates whether the CMU is in the signalling state *Call Release in Progress* or *Call Release Failed*. In the signalling state *Call Failed*, an additional softkey *(Retry Call Release)* allows to re-initiate a call release.

Signalling Info

The *Signalling Info* softkey activates the output table (for scrolling etc.).

In the output window, all Radio Resources *(RR)*, Mobility Management *(MM)*, and Call Control *(CC)* procedures, i.e. all RR, MM, and CC messages sent and received by the CMU, are displayed.

Remote control –

Stop Call Release

The *Stop Call Release*softkeys stop the call release process.

The CMU returns to the signalling state *Unsynchronized*.

Remote control `PROCedure:SIGNalling:ACTion SREL`

Retry Call Release

The *Retry Call Release* softkey initiates a new call release.

This softkey is available in the *Call Release Failed* state only. The CMU changes to the signalling state *Call Release in Progress*.

Remote control `PROCedure:SIGNalling:ACTion RREL`

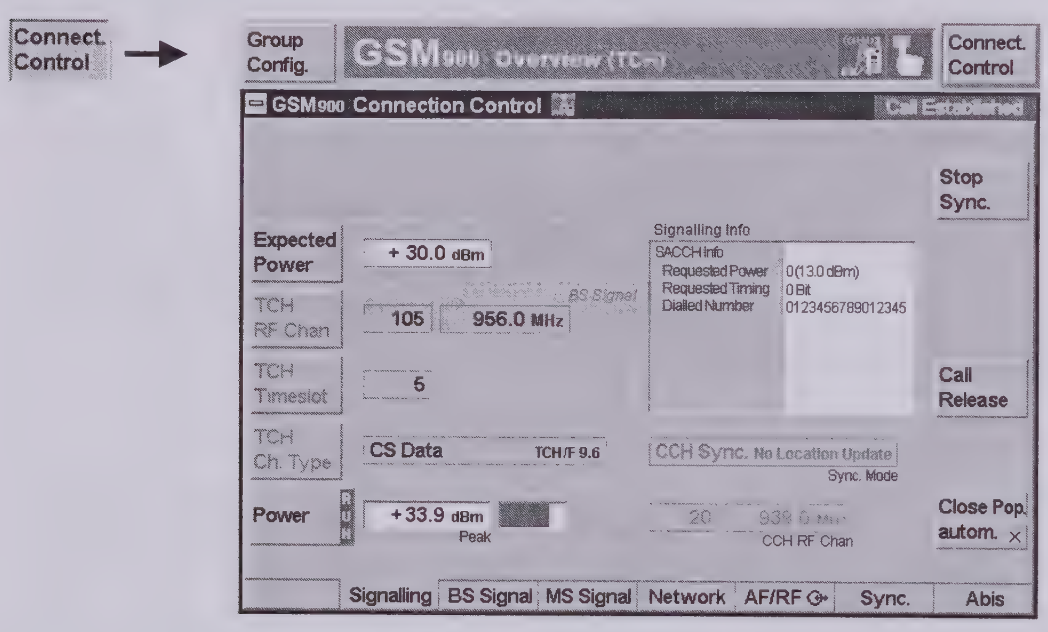
Call Established (TCH) (with Option CMU-K39 only)

The *Signalling (Call Established)* tab indicates

- The maximum expected power from the base station *(Expected Power)*, the channel *(TCH RF Channel), Timeslot,* and *TCH Ch. Type* of the BTS traffic channel to be analyzed (panel *BTS Signal)*
- Status and result of peak-power measurement *(Power)*

Besides, it provides information transmitted via the SACCH associated to the TCH *(Signalling Info),* displays the *synchronization mode* and the *CCH number* that were used for synchronization (see p. 4.67), and offers a softkey to release the call *(Call Release).*

The *Call Established* state is mainly intended for testing the signalling properties of the BTS under test. All TCH measurements are also provided in the *TCH Test* state.



Expected Power: + 30.0 dBm

TCH RF Chan: 105 956.0 MHz

TCH Timeslot: 5

TCH Ch. Type: CS Data TCH/F 9.6

Power: +33.9 dBm Peak

Signalling Info

SACCH Info

Requested Power: 0(13.0 dBm)

Requested Timing: 0 Bit

Dialled Number: 0123456789012345

Sync. Mode: CCH Sync. No Location Update

CCH RF Chan: 20 939.0 MHz

Fig. 4-46 Connection Control – Signalling (Call Established)

The function of the softkeys in the left half of the menu and of the *Close Pop. autom.* softkey (which is analogous to the *Open Pop. autom.* softkey) is described in the section *Signalling Control (State Unsynchronized)* on page 4.64 ff (with an established call, the traffic channel number, timeslot, and *TCH Ch. Type* is fixed and the corresponding softkeys are greyed).

Signalling Info	The table *Signalling Info* indicates signalling information that is transferred by the base station via the SACCH (Slow Associated Control Channel) associated to the allocated traffic channel.	
	Requested Power	Power control level and (in brackets) corresponding maximum output power that the base station tries to set at the CMU/mobile station.
	Requested Timing	Timing advance value of the CMU as requested by the base station
	Dialed Number	Number dialed by the CMU as set in the *Network* tab (see p. 4.106 ff)

Remote control

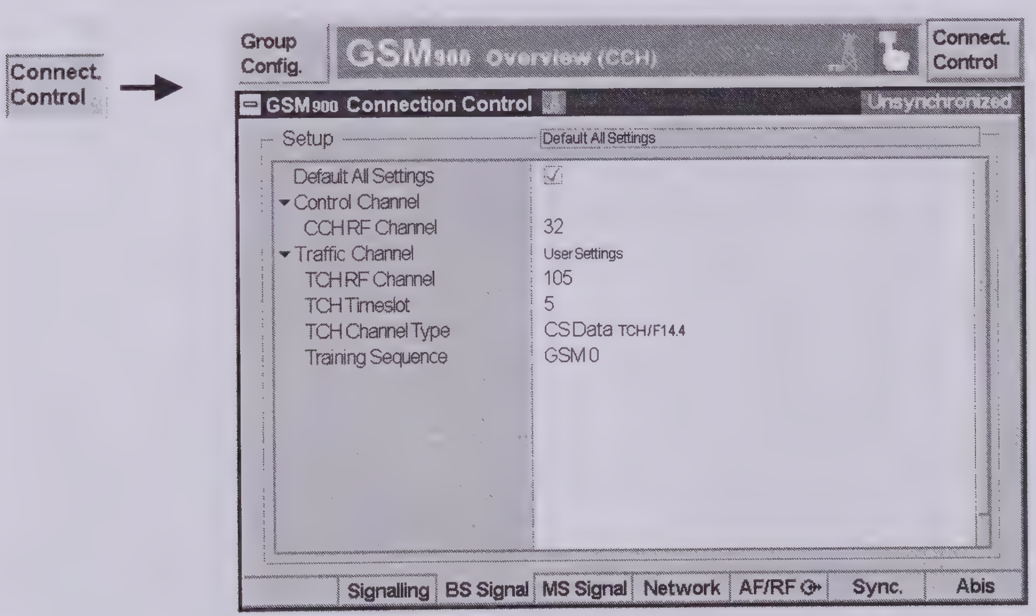
```
[SENSe:]INFO:SACChinfo:REQuested:POWer?
[SENSe:]INFO:SACChinfo:REQuested:TIMing?
CONFigure:NETWork:SUBScriberid:DNUMber?
```

Stop Sync.	The *Stop Sync.* softkey stops the synchronization process. The CMU returns to the signalling state *Unsynchronized*, see p. 4.64.
Remote control	`PROCedure:SIGNalling:ACTion SOFF`
Call Release	The *Call Release* softkey releases the call. The CMU changes to the signalling state *Call Release*, see p. 4.100.
Remote control	`PROCedure:SIGNalling:ACTion REL`

Signals of the Base Station (Connection Control – BS Signal)

The *BS Signal* tab configures the RF signals expected from the base station. It provides the following settings:

- Channel number of the BTS control channel *(CCHRF)*
- Channel number *(TCH RF Channel)*, *Timeslot*, *TCH Channel Type*, and *Taining Sequence* of the BTS traffic channel


Connect. Control
Group Config.
GSM900 Overview (CCH)
Connect. Control
GSM900 Connection Control
Unsynchronized
Setup
Signalling
BS Signal
MS Signal
Network
AF/RF
Sync.
Abis

Setup	Default All Settings
Default All Settings	☑
Control Channel	
CCH RF Channel	32
Traffic Channel	User Settings
TCH RF Channel	105
TCH Timeslot	5
TCH Channel Type	CS Data TCH/F14.4
Training Sequence	GSM 0

Fig. 4-55 Connection Control – BS Signal

Default Settings	The *Default All Settings* switch assigns default values to all parameters of the *BS Signal* tab.
Remote control	`DEFault:BSSignal <Mode>`
Control channel	The section *Control Channel* contains the parameters for the BTS control channel (C0 carrier) used for synchronization. *CCHRF Channel* Number of control channel. For an overview of GSM channels see section *Control of Input and Output Signals* on page 4.49.
Remote control	`CONFigure:BSSignal:CCH:CHANnel <ChannelNo>`

Traffic channel The section *Traffic Channel* contains the parameters for the BTS traffic channel. The first three parameters are also provided in the *Signalling (Unsynchronized*) tab, see section *Panel BTS Signal* on page 4.65 ff.

TCH RF Channel	Number of traffic channel. For an overview of GSM channels see section *Control of Input and Output Signals* on page 4.49.
TCH Timeslot	Number of (used) timeslot
TCH Chan. Type	Speech coding and transmission rate in the traffic channel.
Training Sequence	Training sequence of the BTS traffic channel. This training sequence is used for wired synchronization; it is irrelevant in the *No Loc. Update CCH (fix)* synchronization mode (see *Sync. Mode* softkey on p. 4.67).

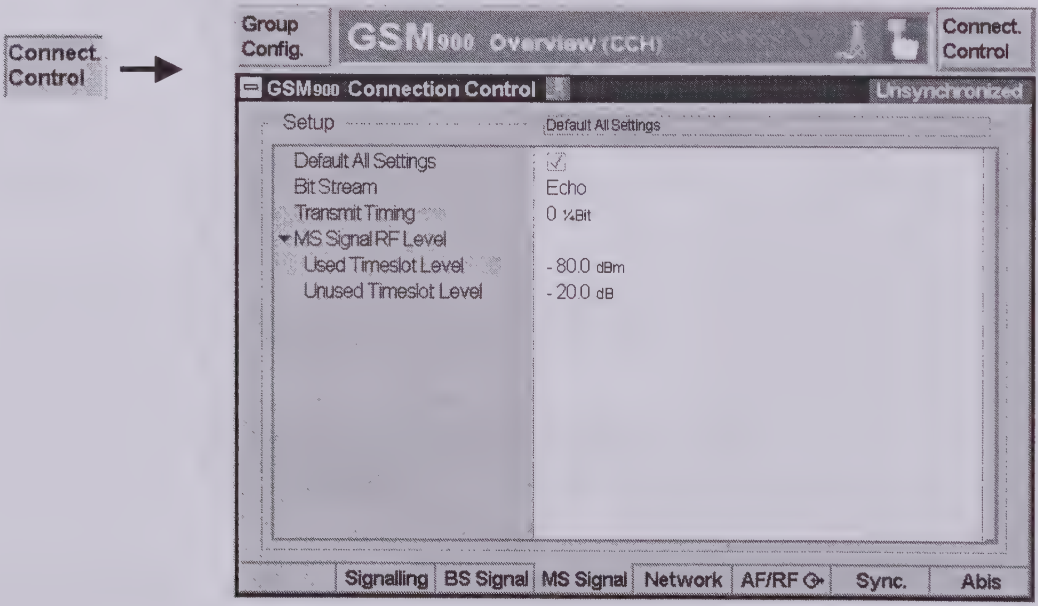
Remote control

```
CONFigure:BSSignal:TCH:CHANnel <ChannelNo>
CONFigure:BSSignal:TCH:TIMeslot <TimeslotNo>
CONFigure:BSSignal:TCH:CHTYpe <Type>
CONFigure:BSSignal:TCH:TSEQuence <TSC>
```

Signals of the CMU (Connection Control – MS Signal)

The *MS Signal* tab configures the signals of the CMU (which simulates a mobile station transmitting a traffic channel signal) and the transmission parameters. The *MS Signal* tab provides the following settings:

- The parameters for transmission or retransmission of a received signal *(Bit Stream, Transmit Timing)*
- The level of the MS Signal *(MS Signal RF Level)*



Setup: Default All Settings

Default All Settings ☑
Bit Stream Echo
Transmit Timing 0 ¼Bit
MS Signal RF Level
Used Timeslot Level - 80.0 dBm
Unused Timeslot Level - 20.0 dB

Fig. 4-56 Connection Control – MS Signal

Default Settings The *Default All Settings* switch assigns default values to all parameters of the *MS Signal* tab.

Remote control `DEFault:MSSignal <Mode>`

Bit Stream The table line *Bit Stream* defines the data transmitted in the traffic channel.

Echo	Loop-back mode with delay. The CMU sends back all data received on the TCH after 50 speech frames (Echo).
Loop	Loop-back mode with minimum delay: The CMU sends back all data received on the TCH after 1 speech frame.
Loop Burst by B.	Loop-back mode without channel coding/decoding; see Fig. 4-57 below. This mode is available only if *TCH Chan. Type Speech...* or *ECSD E-TCH/F43.NT* is selected (see *TCH Chan. Type* softkey on p. 4.66).
PSR 2E9-1	Transmission of the pseudo random sequence to CCITT O.153.
PSR 2E11-1	Transmission of the pseudo random sequence to CCITT O.153.
PSR 2E15-1	Transmission of the pseudo random sequence to CCITT O.151.
PSR 2E16-1	Transmission of a pseudo random sequence (Polynomial: $x^{16}+x^5+x^3+x^2+1$)
Handset	The CMU sends a bit pattern generated by an analog signal on the speech coder/decoder (*Speech* connector at the front panel of the instrument).

Note: *All* Receiver Quality *measurements (including the* Burst by Burst *mode) one of the pseudo random sequences must be used. If no pseudo random sequence is selected when a* Receiver Quality *measurement is activated the CMU automatically switches over to* PSR 2E16-1.

Remote control `CONFigure:MSSignal:BITStream <Mode>`

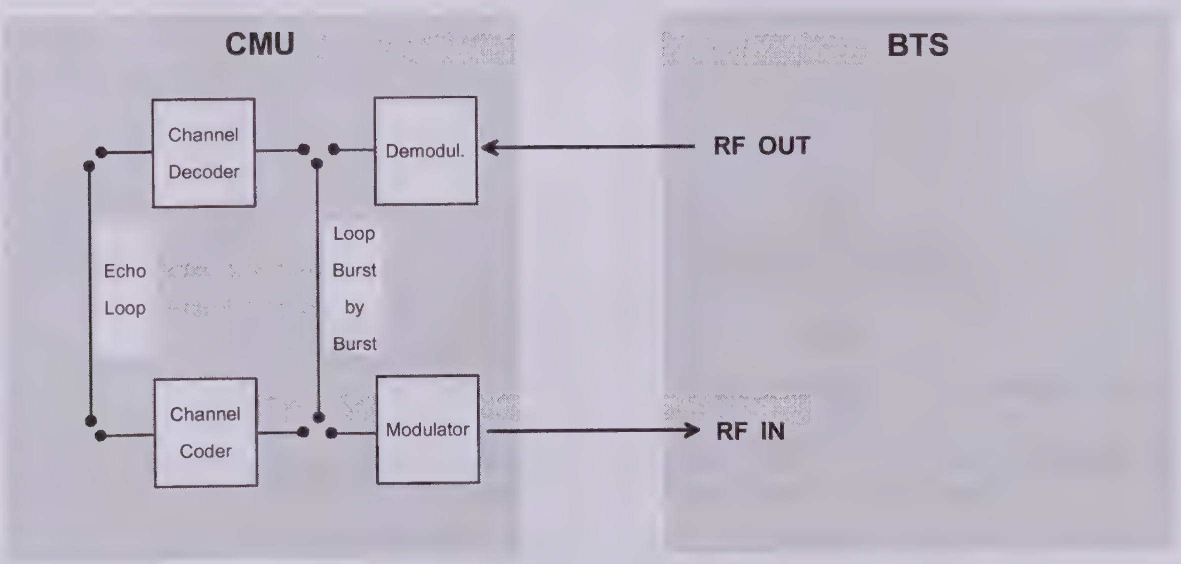


Fig. 4-57 Signal paths for different bit stream settings

Transmit Timing The table line *Transmit Timing* defines a timing offset for the transmission signal. The value is entered in multiples of ¼ bit and can be used to modify the default offset of three slots between reception and retransmission.

Remote control `CONFigure:MSSignal:TXTiming <Mode>`

MS Signal RF Level The section *MS Signal RF Level* defines the level of the traffic channel RF signal transmitted by the CMU.

Used Timeslot Level	Absolute level (in dBm) in the used timeslot

Unused Timeslot Level	Level in the unused timeslots (in dB, relative to the level in the used timeslot)

The permissible value range for the RF levels depends on the RF output selected and of the external attenuation set; see section *Control of Input and Output Signals (Non Signalling)* on p. 4.49 ff.

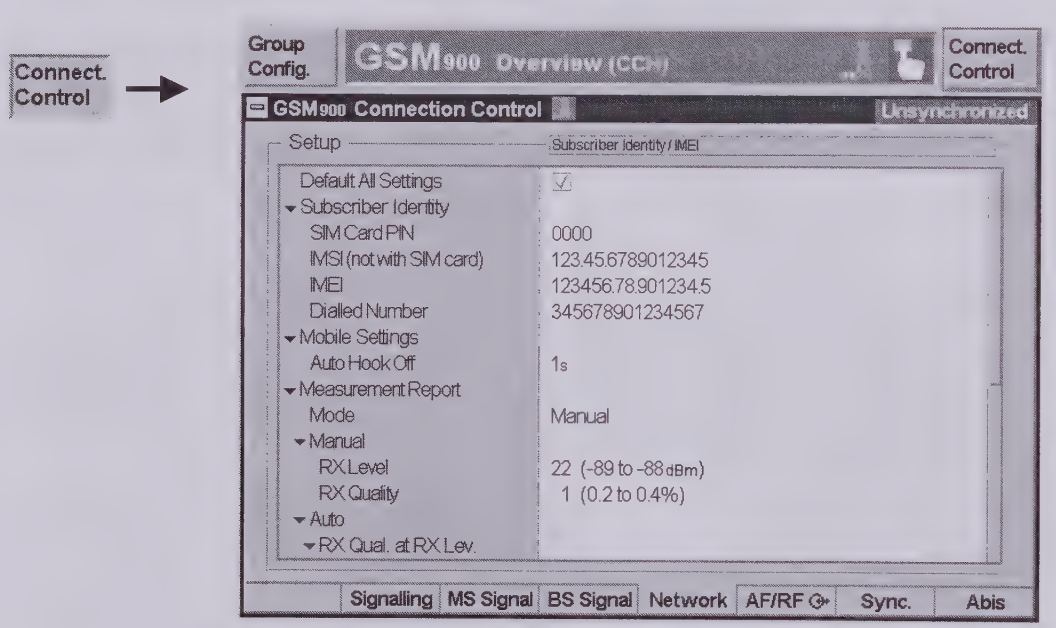
Remote control

```
CONFigure:MSSignal:LEVel:UTIMeslot <Level>
CONFigure:MSSignal:LEVel:UNTimeslot <Level>
```

Network Parameters (Connection Control – Network, with Option CMU-K39 only)

The *Network* tab defines various parameters of the network and the mobile station. This includes

- Parameters identifying the mobile station and the subscriber *(Subscriber Identity)*
- *Mobile Settings*
- Configuration of the *Measurement Reports* of the mobile station


Connect. Control
Group Config.
GSM900 Overview (CCH)
Connect. Control
GSM900 Connection Control
Unsynchronized
Setup
Subscriber Identity / IMEI
Signalling
MS Signal
BS Signal
Network
AF/RF
Sync.
Abis

Setup	
Default All Settings	☑
Subscriber Identity	
SIM Card PIN	0000
IMSI (not with SIM card)	123.45.6789012345
IMEI	123456.78.901234.5
Dialled Number	345678901234567
Mobile Settings	
Auto Hook Off	1s
Measurement Report	
Mode	Manual
Manual	
RX Level	22 (-89 to -88 dBm)
RX Quality	1 (0.2 to 0.4%)
Auto	
RX Qual. at RX Lev.	

Fig. 4-58 Connection Control – Network parameters

Default Settings The *Default All Settings* switch sets all parameters of the *Network* tab to their default values (see command description in chapter 6).

Remote control

```
DEFault:NETWork  ON | OFF
```

Subscriber Identity The field *Subscriber Identity* contains parameters characterizing the CMU/mobile station and the subscriber:

SIM Card PIN	4- to 8-digit Personal Identification Number, usually stored on the SIM card of the GSM mobile phone ,
IMSI	International Mobile Subscriber Identity in the format MCC.MNC.MSIN
MCC	3-digit Mobile Country Code
MNC	2-digit Mobile Network Code
MSIN	10-digit Mobile Subscriber Id. No.

IMEI	International Mobile Station Equipment Identity in the format TAC.FAC.SNR.SVN
TAC	6-digit Type Approval Code
FAC	2-digit Final Assembly Code
SNR	6-digit Serial No.
SVN	1|2-digit Software Version Number
Dialed Number	Number dialed at the CMU/mobile station to attempt the call connection (Mobile Originated Call,MOC),

Remote control `CONFigure:NETWork:SUBScriberid...`

Mobile Settings The *Mobile Settings* field sets the time after which the CMU automatically accepts a call from the BTS (MTC) and assumes the *Call Established* signalling state.

Remote control `CONFigure:NETWork[:MS]:AUTohoohoff <Time>`

Measurement Report The *Measurement Report* section configures the measurement report containing the signal strength and quality of the base station signal received and measured by the CMU/mobile phone.

The received signal level or RX Level is expressed in terms of dimensionless power levels that depend linearly on the absolute measured power (expressed in dBm). A high RX Level implies a high received signal input power and vice versa:

Table 4-7 Definition of RX Level

Value of RX Level	Corresponding signal strength
63	> –48 dBm
62	–49 dBm to –48 dBm
62	–50 dBm to –49 dBm
...	...
2	–109 dBm to –108 dBm
1	–110 dBm to –109 dBm
0	< –110 dBm

The received signal quality or RX Quality is expressed in terms of dimensionless quality levels (actually "error levels") that depend linearly on the logarithm of the bit error rate. A high quality level implies a high bit error rate and thus a **poor** received signal quality:

Table 4-8 Definition of RX Quality

Value of RX Quality	Bit error rate
0	0% to 0.2%
1	0.2% to 0.4%
2	0.4% to 0.8%
3	0.8% to 1.6%
4	1.6% to 3.2%
5	3.2% to 6.4%
6	6.4% to 12.8%
7	12.8% to 100%

Mode

The *Mode* parameter determines in which way the measurement reports are generated and transmitted to the base station:

Manual	Both the RX Level and the RX Quality value are entered manually and transmitted to the base station
Auto RX Quality	The RX Level is entered manually; the CMU selects the corresponding RX Qual from the *Auto* table (see below) and transmits both values to the base station.
Auto RXQual & RXLev	The CMU measures the RX Level, selects the corresponding RX Qual from the *Auto* table (see below) and transmits both values to the base station.

Remote control

```
CONFigure:NETWork:MREPort:MODE
          MANual | RXQualauto | AUTomatic
```

Manual

The *Manual* section defines an RX Level and an RX Quality value to be transmitted to the base station if the measurement report is configured in *Manual* mode.

RX Level	Input value for the received signal strength, see Table 4-7
RX Quality	Input value for the received signal quality, see Table 4-8

Remote control

```
CONFigure:NETWork:MREPort:MANual...
```

Auto

The *Auto* section configures a table defining a correlation between the RX Level and RX Quality values. The RX Quality, as a function of the RX Level measured or entered manually, is taken from this table and transmitted to the base station if the measurement report is configured in *Auto RXQual & RXLev* or in *Auto RX Quality* mode.

Note that, although both the RX Level and RX Quality scales are fixed according to Table 4-7 and Table 4-8; the correlation between the two is arbitrary.

Remote control

```
CONFigure:NETWork:MREPort:AUTO...
```

Auto RX Qual

The *Auto RX Qual* section defines an RX Level to be transmitted to the base station if the measurement report is configured in *Auto RX Quality* mode. The corresponding RX Qual value is taken from the *Auto* table, see above.

Remote control

```
CONFigure:NETWork:MREPort:AUTO:RXLevel <Level>
```

Auto RX Lev and RX Qual

The *Auto RX Lev and RX Qual* section modifies the measured RX Level to be transmitted to the base station if the measurement report is configured in *Auto RXQual & RXLev* mode: RX Level is measured, the corresponding RX Qual value is taken from the *Auto* table (see above), then the RX Level value is offset.

Offset	Relative offset value (in dB) by which the measured RX Level is shifted

The offset value can be used to better simulate what happens in a real network where the mobile receives an RF signal from the base station that was attenuated on its propagation path.

Remote control

```
CONFigure:NETWork:MREPort:AUTO:RXOFfset <Offset>
```

RF Connectors (Connection Control – Connector/Ext. Att.)

The ···/*Ext. Att.* tab selects the connectors for RF signals. This includes determination of

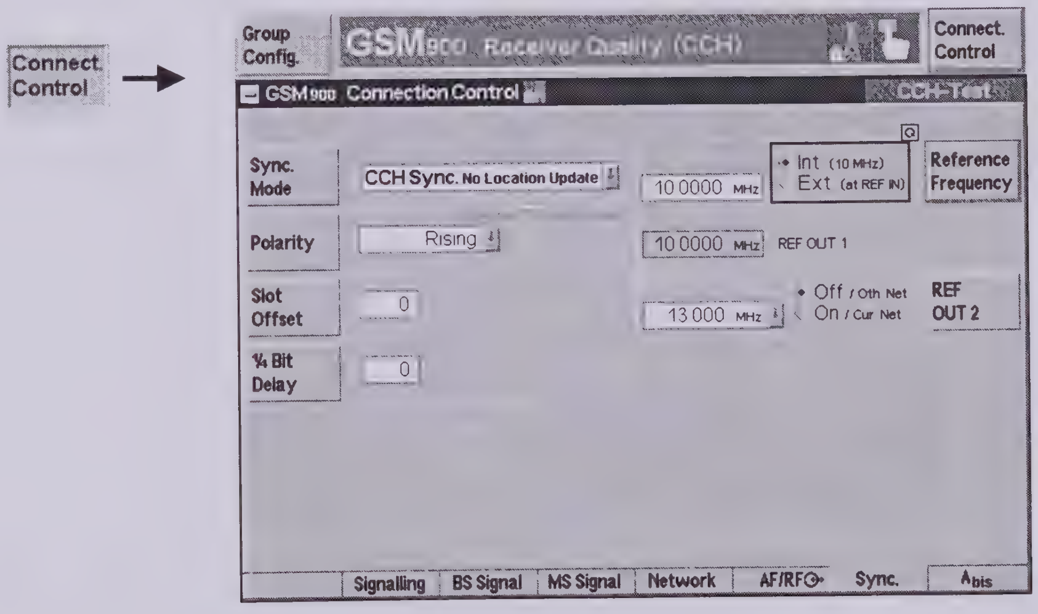
- RF input and RF output at the CMU *(RF Output, RF Input)*,
- An external attenuation at the connectors *(Ext. Att. Output, Ext. Att. Input)*.

The functions of this menu are described in the section *GSM400/900/1800/1900-BTS Non Signalling* on page 4.56.

Reference Frequency (Connection Control – Sync.)

The *Sync.* tab determines the reference signal for synchronization. This includes

- The selection of internal or external *Reference Frequency*
- Configuration of the network-specific clock frequency *(REF OUT 2)*
- The synchronization mode *(Sync. Mode)*



Sync. Mode: CCH Sync. No Location Update

Polarity: Rising

Slot Offset: 0

¼ Bit Delay: 0

Reference Frequency: 10.0000 MHz ● Int (10 MHz) ○ Ext (at REF IN)

REF OUT 1: 10.0000 MHz

REF OUT 2: 13.000 MHz ● Off / Oth Net ○ On / Cur Net

Fig. 4-59 Connection Control – Sync.

The functions in the right half of this menu are described in the section *GSM400/900/1800/1900-BTS Non Signalling* on page 4.58. The *Sync. Mode* softkey is identical with the *Sync. Mode* softkey described on page 4.67. The softkeys in the *External Trigger Input* panel configure the *Wired Sync. (External Trigger)* synchronization mode. These settings are have no impact on any other synchronization modes.

Polarity

The *Polarity* softkey defines whether the rising or falling edge of the external trigger signal is used for synchronization.

Remote control `CONFigure:EXTernal[:TRIGger][:INPut]:POLarity <Polarity>`

Slot Offset

The *Slot Offset* softkey defines a number of timeslots by which the TX TCH signal of the CMU is shifted relative to the external trigger signal.

This delay time can be further modified by adding a *¼ Bit Delay*, see below.

Remote control	`CONFigure:EXTernal[:TRIGger][:INPut]:SOFFset <Offset>`
¼ Bit Delay	The *¼ Bit Delay* softkey defines a delay time in ¼ bit units that is added to the slot offset defined by the softkey above.
Remote control	`CONFigure:EXTernal[:TRIGger][:INPut]:BITDelay <Delay>`

Popup Menu Group Configuration

The popup menu *Group Configuration* contains two tabs which configure the measurements of the function group *GSM400/900/1800/1900-BTS Signalling* globally, i.e. for all measurement menus. Most of the *Group Configuration* settings can be modified for an individual measurement using the softkeys and popup input fields provided in the graphical menus.

The popup menu *Group Configuration* is activated by pressing the softkey *Group Config.* at the top left of each measurement menu. Pressing of the associated hotkeys permits to change between the tabs.

Input Power (Group Configuration – Input Power)

The tab *Input Power* provides general settings for the RF input path.

The functions of this menu are described in the section *GSM400/900/1800/1900-BTS Non Signalling* on page 4.60.

Trigger (Group Configuration – Trigger)

The tab *Trigger* defines the trigger condition. It is described in the section *GSM400/900/1800/1900-BTS Non Signalling* on page 4.62. Note that, in contrast to the *Non Signalling* mode, the measurement must be triggered by the signal from the base station or the signalling unit; an external trigger signal cannot be used.

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5 Remote Control – Basics

This chapter gives a survey of the basic features and concepts of GSM remote control commands. Remote control can be described in terms analogous to the ones used in chapter 3 for the classification of menus and settings for the graphical user interface. In the following, we will particularly point out the similarities and differences between manual and remote control.

Structure and Order of Commands

Chapter 6 of this manual lists gives a description of all GSM remote control commands, including their parameters, default values and permissible ranges.

Function group and mode

The commands for the function groups *GSM400-BTS, GSM900-BTS, GSM1800-BTS* and *GSM1900-BTS* are identical, however, the ranges or default values of their numerical parameters may not coincide. Numerical values are explicitly quoted for all three function groups.

Commands for the two modes *Signalling* and *Non Signalling* are listed separately although many of them have the same syntax.

Addressing

The function group and mode is specified via the secondary address of each command while the instrument is identified by the primary address. This allows the same remote commands to be used in several function groups and modes:

```
ibwrt(h_GSM400BTS_SIG, "INITiate:POWer:NBURst:GMSK")
ibwrt(h_GSM900BTS_SIG, "INITiate:POWer:NBURst:GMSK")
ibwrt(h_GSM1800BTS_SIG, "INITiate:POWer:NBURst:GMSK")
ibwrt(h_GSM900BTS_NSIG, "INITiate:POWer:NBURst:GMSK")
```

provided that the variables `h_GSM900BTS_SIG, etc.` have been appropriately defined, see program examples in chapter 7 of the CMU operating manual.

The remote control commands for first `(SYST:COMM:GPIB:ADDR)` and secondary `(SYST:REM:ADDR:SEC)` addressing are described in the CMU operating manual.

Order of commands

The commands are arranged to form groups belonging to the same measurement or performing the same type of configurations. These groups are identified by the second-level keyword (as in `POWer`). Applications belonging to a measurement group (see chapter 5 of the CMU operating manual) are identified by the third-level keyword of each command (as in `SPECtrum:MODulation`). Chapter 6 is organized as follows:

- General configurations in the *Non Signalling* mode `(LEVel, TRIGger, RFANalyzer, RFGenerator, INPut, OUTPut, CORRection:LOSS, DM:CLOCk)`
- Measurement groups in the *Non Signalling* mode `(WPOWer, POWer, MODulation, SPECtrum)`
- General configurations and signalling in the *Signalling* mode `(LEVel, TRIGger, SIGNalling, MSSignal, INPut, OUTPut, CORRection:LOSS, DM:CLOCk)`
- Measurement groups in the *Signalling* mode `(WPOWer, INFO, POWer, MODulation, SPECtrum:MODulation, SPECtrum:SWITching, RXQuality:BER, RXQuality:BAVerage)`

The structure of chapter 6 differs from chapter 4 *(Functions and their Application)* where the measurements are presented first and special configurations are reported at the end of each signalling mode section.

The menu of the graphical user interface corresponding to a group of commands is quoted at the beginning of each section. An alphabetical list of all commands is annexed to chapter 6.

SCPI Conformity In view of the particular requirements of GSM measurements not all commands could be taken from the SCPI standard. However, the syntax and structure of all commands is based on SCPI rules. For a detailed description of the SCPI standard refer to chapter 5 of the CMU operating manual.

Remote Control All commands may be used for control of the CMU via GPIB interface.

Measurement Control

The commands in the measurement groups `WPOWer`, `POWer`, `MODulation`, `SPECtrum`, and `RXQuality` have an analogous structure and syntax. The measurements are controlled according to common concepts which are explained in detail in Chapter 5 of the CMU operating manual. The following sections show how the general concepts are applied to GSM-MS measurements.

Measurement Groups

The measurement groups are referred to as *measurement objects* (keyword <meas_obj>) in remote control. Most measurement objects correspond to a measurement group or application in manual control. For GSM-BTS measurements, the following measurement objects are defined:

Table 5-1 Measurement objects in Signalling and Non Signalling mode

Non Signalling		**Signalling**	
Meas. Object	**Measurement group / Application**	**Meas. Object**	**Measurement group / Application**
`WPOWer`	*Power* softkey (wide-band peak power measurement).	`WPOWer`	Power softkey (wide-band peak power measurement).

`POWer:NBURst:GMSK`
`POWer:NBURst:EPSK`
	P/t Norm. GMSK
	P/t Norm. 8PSK
	Burst power as a function of time.
		`POWer:NBURst:GMSK:CCH`
		`POWer:NBURst:GMSK:TCH`
		`POWer:NBURst:EPSK:TCH`
			P/t Norm. GMSK
			P/t Norm. 8PSK
			Burst power as a function of time, control channel test (GMSK only) and traffic channel test..

		`POWer:SLOT:GMSK:TCH`	*P/Slot* Average burst power in 8 timeslots of a TDMA frame.
`MODulation[:PERRor]:GMSK`	*Phase Err. GMSK* Fast phase and frequency error measurement excluding the I/Q imbalance and origin offset.	`MODulation[:PERRor]:GMSK:CCH` `MODulation[:PERRor]:GMSK:TCH`	*Phase Err. GMSK* Fast phase and frequency error measurement excluding the I/Q imbalance and origin offset, control channel test (GMSK only) and traffic channel test..
`MODulation:OVERview:EPSK`	*Overview 8PSK* 8PSK scalar modulation	`MODulation:OVERview:EPSK:TCH`	*Overview 8PSK* 8PSK scalar modulation pa-

Non Signalling		Signalling	
Meas. Object	**Measurement group / Application**	**Meas. Object**	**Measurement group / Application**
	parameters including statistical evaluation.		rameters including statistical evaluation, traffic channel test.
`MODulation:EVMagnitude:EPSK`	*EVM 8PSK* Error vector magnitude in 8PSK modulation.	`MODulation:EVMagnitude:EPSK:TCH`	*EVM 8PSK* Error vector magnitude in 8PSK modulation, traffic channel test.
`MODulation:PERRor:EPSK`	*Phase Error 8PSK* Phase error in 8PSK modulation.	`MODulation:PERRor:EPSK:TCH`	*Phase Error 8PSK* Phase error in 8PSK modulation, traffic channel test.
`MODulation:MERRor:EPSK`	*Magn. Error 8PSK* Magnitude error in 8PSK modulation.	`MODulation:MERRor:EPSK:TCH`	*Magn. Error 8PSK* Magnitude error in 8PSK modulation, traffic channel test.

`SPECtrum:MODulation:GMSK`
`SPECtrum:MODulation EPSK`
	Modulation GMSK
	Modulation 8PSK
	Off-carrier power due to the modulation.
		`SPECtrum:MODulation:GMSK:CCH`
		`SPECtrum:MODulation:GMSK:TCH`
		`SPECtrum:MODulation:EPSK:TCH`
			Modulation GMSK
			Modulation 8PSK
			Off-carrier power due to the modulation, control channel test (GMSK only) and traffic channel test..

`SPECtrum:SWITching:GMSK`
`SPECtrum:SWITching EPSK`
	Switching GMSK
	Switching 8PSK
	Off-carrier power due to the switching transients.
		`SPECtrum:SWITching:GMSK:CCH`
		`SPECtrum:SWITching:GMSK:TCH`
		`SPECtrum:SWITching:EPSK:TCH`
			Switching GMSK
			Off-carrier power due to the switching transients control channel test (GMSK only) and traffic channel test..

–		`RXQuality:BER<nr>`, `RXQuality:BAVerage`	*BER CMU* *BER CMU Average* Receiver quality measurements, i.e. measurement of the bit error rate and the residual bit error rate, with limit check.

The measurement groups are complemented by configuration settings for the inputs and outputs, input and output signals, trigger. In the signalling mode, the MS signal and network parameters can be configured or read out in addition. For a quick overview, see the list of remote control commands at the end of chapter 6.

Measurement Statistics

The *repetition mode* defines how many evaluation periods are measured if the measurement is not stopped explicitly (measurement control commands `STOP...`, `ABORT...`) or by a limit failure. With remote control the three repetition modes *Single Shot, Continuous* and *Counting* are available (*Counting* is not available in manual control, see chapter 3).

In `POWer`, `MODulation`, and `SPECtrum` measurements, different traces corresponding to the result in the current period, the maximum, minimum, or average evaluated over a set of periods are determined within one measurement. The four results can be queried independently.

Table 5-2 Repetition mode in remote control

Setting	Description	Command

Statistic Count	Integer number of evaluation periods forming one statistics cycle. An evaluation period is equal to a burst length (`POWer | MODulation | SPECtrum`) or a frame (`RXQuality` measurements).
	The statistic count is set together with the measured quantity.
		`CONFigure:<meas_obj>:CONTrol:STATistics`
		`1 ... 1000 | NONE`
		`(<meas_obj> = POWer | MODulation | SPECtrum:MODulation | SPECtrum:SWITching)`
		`CONFigure:RXQuality:BER<nr>|BAVerage:CONTrol:STATistics`
		`1 ... 500 | NONE`

Repetition mode
Single Shot
	The measurement is stopped after one statistics cycle.	`CONFigure:<meas_obj>:CONTrol:REPetition` **`SINGleshot`**`, <StopCondition>`
		`(<meas_obj> = WPOWer | POWer... | MODulation... | SPECtrum...)`
		`RXQuality:BER` measurements are always performed in single shot mode.

Continuous	The measurement is continued until stopped explicitly or by a limit failure. The statistical window for the calculation of average results is continuously shifted (continuous averaging).	`CONFigure:<meas_obj>:CONTrol:REPetition` **`CONTinuous`**`, <StopCondition>`
		`(<meas_obj> = WPOWer | POWer... | MODulation... | SPECtrum... | RXQuality...)`
		`RXQuality:BAVerage` measurements are always performed in continuous mode.

Counting	Repeated single shot measurement with configured statistics cycles.	`CONFigure:<meas_obj>:CONTrol:REPetition` **`1 ... 10000`**`, <StopCondition>`
		`(<meas_obj> = WPOWer | POWer | MODulation | SPECtrum:MODulation, SPECtrum:SWITching)`
		This mode is not available for `RXQuality` measurements. A counting measurement with 1 evaluation period is equivalent to a single shot measurement..

Traces	The four specifiers CURRent, MAXimum, MINimum, and AVERage allow the trace for the current evaluation period, the maximum, minimum or average of a set of evaluation periods to be retrieved.
	In general all four traces are evaluated during the measurement. They are selected via a keyword in the queries initiating a measurement and retrieving the results.
		Measurement results:
		`READ:ARRay:<meas_obj><disp>?`
		`READ:SUBarrays:<meas_obj><disp>?`
		`....`
		where `<meas_obj> = POWer... | MODulation...`
		Burst matching:
		`CALCULATE:ARRay:POWER:NBURSt...<disp>: MATChing:LIMit?`
		where `<disp> = :CURRent | :AVERage |`
		`:MAXimum | MINimum`

Limit Definition and Limit Checks

The following table gives an overview of the types of limits and possible results of the limit check.

Table 5-3 Limits and limit check

Type	Description	Command
Scalar limits	Limit values for a single (scalar) measured quantity. Depending on the measured quantity, either an upper limit or upper and lower limits can be defined.	`CONFigure:<meas_obj>:LIMit:<Spec.> [<LowerLimit>,]<UpperLimit>` <Spec.> denotes a keyword (an array of keywords) specifying the measured quantity.
Limit lines	For `POWer` and `SPECtrum` measurements a tolerance template consisting of up to 16 time ranges can be defined.	`CONFigure:<meas_obj>:LIMit:LINE:<Spec.> <Limit_line_param.>` <Spec.> denotes the two keywords specifying the upper or lower limit line in a time range and the burst type considered. <Limit_line_param.> contains the coordinates of the start and end points of the limit line plus an information whether the current range is valid or not.
Limit check	All scalar limits belonging to the same measurement group are read out together with the command on the right side.	`CALCulate:<meas_obj.>:MATChing:LIMit?`
	Possible results of the scalar limit check are listed on the right side. Further messages assessing, e.g., the power ramp or the result of the BER test in general, may be issued in particular cases (see detailed command description in chapter 6).	`NMAU` not matching, underflow `NMAL` not matching, overflow `INV` measured value invalid `OK` no limit failure
	The result of the limit check depends on the statistics settings (see section *Measurement Statistics* on page *5.3*).	`CALCULATE::<meas_obj> <disp>:MATChing:LIMit?` where `<disp> = [:CURRent] | :AVERage | :MAXimum | :MINimum`

Status Reporting System

A general description of SCPI status registers and of the status reporting system is given in chapter 5 of the CMU operating manual. This section is devoted to the particular features concerning GSM measurements.

The CMU offers 30 independent `STATus:OPERation:CMU:SUM1|2:CMU<nr>` sub-registers (<nr>=1 ... 15) which are implemented in hierarchical form. The bits of the 30 STATus:OPERation registers are set only after the registers are assigned to a function group and measurement mode.

In the CONDition part, the STATus:OPERation register contains information on which actions the instrument is being executing or, in the EVENt part, information on which actions the instrument has executed since the last readout. All fife parts of the registers can be read using one of the commands of the subsystem `STATus:OPERation:CMU:SUM1|2:CMU<nr>:...` Moreover, the EVENt part can be enabled and read by means of the `STATus:OPERation:SYMBolic...` commands, see section *Symbolic Status Event Register Evaluation* in chapter 5 of the CMU operating manual.

GSM mobile tests comprise the two signalling modes *Non Signalling* and *Signalling* for each of the three function groups *GSM900/1800/1900-BTS* so that a total of 6 secondary addresses is used. In the three status registers for the *Non Signalling* mode the bit assignment is as follows:

Table 5-4 Meaning of the bits used in the `STATus:OPERation:CMU:SUM1|2:CMU<nr>` sub-registers assigned to *GSM900/1800/1900-BTS Non Signalling*

Bit-No.	Meaning	Symbol in `STATus:OPERation:SYMBolic...`
6	**Reference Frequency not synchronized** This bit is set while the reference frequency is not synchronized.	RFNS

In the three status registers for the *Signalling* mode the bit assignment is as follows:

Table 5-5 Meaning of the bits used in the `STATus:OPERation:CMU:SUM1|2:CMU<nr>` sub-registers assigned to *GSM900/1800/1900-BTS Signalling*

Bit-No.	Meaning	Symbol in `STATus:OPERation:SYMBolic...`
0	**Mobile Terminated Call** This bit is set while the CMU receives a call from the base station under test.	MTC
1	**Mobile Terminated Call Clearing** This bit is set while the connection to the base station is being released.	MTCC
2	**Synchronization Lost** This bit is set if the CMU had to leave the signalling state "Synchronized".	SLOS
3	**Location Update** This bit is set while a location update is being performed.	LUPD
6	**Reference Frequency not synchronized** This bit is set if the reference frequency is not synchronized yet.	RFNS

Special Terms and Notation

Below we list some particular features in the syntax of the GSM commands. The general description of the SCPI command syntax can be found in chapter 5 of the operating manual for the CMU basic unit, section *"Structure and Syntax of Device Messages"*.

Description of commands

The commands are arranged in tables; all of them are described along the same scheme. From top to bottom, the table rows contain the following entries:

1. Complete command syntax including the parameter list and a short description of the command,
2. List and description of the parameters with their default values, the units and unit rings.
3. Detailed description of the command, signalling state required for command execution, required firmware version.

Detailed lists of default values are annexed to the command description.

Order of commands

The commands are arranged according to their function. The general purpose of a command is described by the keyword in the second level or in the second/third level combined. Lower-level keywords define the command in more detail. This means that commands with the same second-level, third-level etc. keywords are generally grouped together in the same sections.

Example: `INITiate:POWer:NBURst:GMSK`

Commands with the keyword *POWer* in the second level belong to the power measurement. The keywords in the third and fourth level indicate that the command controls a power measurement on a normal burst with GMSK modulation.

Measurement object

The term *measurement object* denotes a group of remote control commands belonging to the same group of measured quantities. E.g., all commands concerning the measurement of the power form a common measurement object.

A pseudo measurement object concerns quantities which do not actually have to be measured because they are automatically obtained during the signalling process (e.g. the receiver parameters reported by the mobile phone).

Combined measurements

To limit the number of remote control commands and their parameters, scalar results are always measured together and output in lists. Arrays (e.g. the traces for `POWer` and `MODulation` measurements) are output as lists of values separated by commas; it is possible to retrieve either the whole list (see commands `READ:ARRay...` etc.) or the values located in a number of subranges that are part of the total measurement range (see commands `READ:SUBarrays...`; the subarrays are defined via `CONFigure:SUBarrays...`).

Parameters

Many commands are supplemented by a parameter or a list of parameters. Parameters either provide alternative options (setting a or setting b or setting c ..., see special character "|"), or they form a list separated by commas (setting x,y).

<Par_Name>

Alternative settings are described by a common name (literal) written in angle brackets (<>). This literal serves as a description of the parameters only; in an application program it must be replaced by one of the settings given in the detailed parameter description.

Example:

```
CONFigure:POWer:NBURst:GMSK:CONTrol:RMODe
                                       <Mode>
```

with `<Mode> = SCALar | ARRay`

possible syntax: `CONF:POW:NBUR:GMSK:CONT SCAL`

NAN A query will return NAN (not a number) if no result could be obtained (yet), or if the result obtained is invalid. NAN is defined in the SCPI standard. This is why in general NAN is not explicitly quoted in the list of possible values for numeric parameters.

INV If a tolerance values which were not defined previously are queried, the response INV (invalid) is returned.

Upper / lower case Upper/lower case characters characterize the long and short form of the keywords in a command. The short form consists of all upper-case characters, the long form of all upper case plus all lower case characters. On the CMU, either the short form or the long form are allowed; mixed forms will generally not be recognized. Note that the instrument itself does not distinguish upper case and lower case characters.

Special characters

| A vertical stroke in the parameter list characterizes alternative parameter settings. Only one of the parameters separated by | must be selected.

Example: The following command has two alternative settings:

```
DEFault:TRIGger[:SEQuence] ON | OFF
```

[ ] *Key words* in square brackets can be omitted when composing the command header (see chapter 5 of the CMU manual, section "Structure of a Command"). The complete command must be recognized by the instrument for reasons of compatibility with the SCPI standard.

Parameters in square brackets are optional as well. They may be entered in the command or omitted.

{ } Braces or curly brackets enclose one or more parameters that may be included zero or more times.

<nr> This symbol denotes a numeric suffix, e.g. an enumeration index for input and output connectors.

Alphabetical list of commands

Command: The *Command* column of the table contains all remote control commands arranged according to their function (configurations or measurement objects). Within a section, the commands are listed by alphabetical order.

Parameters: The *Parameter* column lists the parameters of the commands.

Remarks: The *Remarks* column gives additional information about the commands which

- Have no query form *(no query)*
- Have only a query form *(query only)*
- Can be used both as setting commands and as queries (*with query*, this applies to all commands belonging to none of the two preceding categories)

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6 Remote Control – Commands

In the following, all remote-control commands for the function groups *GSM400/900/1800/1900-BTS* will be presented in tabular form with their parameters and the ranges of values. The structure of this chapter is analogous to that of the reference part for manual operation (chapter 4).

- The measurement modes *Non Signalling* and *Signalling* are presented separately.
- Within the measurement modes, first the general configuration and then the individual measurement groups (test objects) are dealt with.

General notes on remote control in the function group *GSM400/900/1800/1900-BTS* can be found in chapter 5. An introduction to remote control according to SCPI standard and the status registers of the CMU is given in chapter 5 of the operating manual for the CMU200 basic instrument.

GSM Module Tests (Non Signalling)

In the *Non Signalling* mode, a GSM-specific RF signal can be generated and an RF signal with GSM characteristics can be analyzed. No signalling parameters are transferred.

Group Configuration

The remote-control commands in this section are used to configure the measurements in the function group *GSM-BTS Non Signalling* globally, i.e. they provide settings that are valid for all measurements within the function group. They correspond to the settings in the popup menu of the softkey *Group Config.* located to the left of the headline of each main menu.

Subsystem EPOWer (Expected Input Power)

The subsystem *EPOWer* determines the expected input power for the currently used input. It corresponds to the tab *Input Level* in the popup menu *Group Configuration*.

[SENSe:]EPOWer:MODE <*Mode*>				Input Power – Mode
<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
MANual | **AUTomatic**	Manual setting Automatic setting corresponding to average power of signal applied	AUT	–	
Description of command				FW vers.
This command defines the mode for setting the maximum input level.				V2.80

[SENSe:]EPOWer:VALue *<Power>*				Max. Level
<Power>	Description of parameters	Def. value	Def. unit	Unit ring
0 dBm to +53 dBm **–14 dBm to +39 dBm** **–37 dBm to 0 dBm**	Maximum input level for RF 1 Maximum input level for RF 2 Maximum input level for RF 4 IN	30.0 30.0 0.0	dBm dBm dBm	
Description of command				FW vers.
This command defines the maximum input level. The setting is possible even if the level is determined automatically (command `EPOW:MODE AUT`). The permissible value range depends on the RF input used and the external attenuation set (see `[SENSe:]CORRection:LOSS:INPut<nr>[:MAGNitude]` command).				V2.80

[SENSe:]EPOWer:ATTenuation *<Mode>*				Attenuation
<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
NORMal | **LNOise |** **LDIStortion**	Mixer level in normal range Low noise (mixer level 10 dB higher than in normal setting) Low distortion (mixer level 10 dB lower than in normal setting)	LNOise	–	–
Description of command				FW vers.
This command defines an attenuation or gain factor for the RF input signal.				V2.80

DEFault:EPOWer <Enable>				Default Settings
<Enable>	Description of parameters	Def. value	Def. unit	Unit ring
ON | **OFF**	All parameters are set to their default values Some or all parameters differ from the default values	ON	–	–
Description of command				FW vers.
If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to their default values (the setting *OFF* has no effect). If used as a query the command returns whether all parameters are set to their default values *(ON)* or not *(OFF)*.				V2.80

Subsystem TRIGger (Trigger Mode)

The subsystem *TRIGger* determines the trigger mode. It corresponds to the tab *Trigger* in the popup menu *Group Configuration*.

TRIGger[:SEQuence]:SOURce <*Source*> Trigger Source

<Source>	Description of parameters	Def. Value	Def. unit	Unit ring
FRUN	The power measurement is triggered by the TDMA timing	IFPower	–	–
RFPower	The power measurement is triggered by the incoming RF power (rising edge)			
IFPower	The power measurement is triggered by the IF power (rising edge)			
EXTern	External trigger signal at socket AUX3			

Description of command	FW vers.
This command determines the trigger condition. The setting *FRUN* assumes bursted signals.	V2.80

TRIGger[:SEQuence]:THReshold <*Threshold*> Trigger Level

<Threshold>	Parameter description	Def. value	Default unit	Unit ring
LOW |	Low trigger threshold (reference level - 26 dB)	MEDium	–	–
MEDium |	Medium trigger threshold (reference level - 16 dB)			
HIGH	High trigger threshold (reference level - 6 dB)			

Command description	FW vers.
This command sets the trigger level, i.e. the signal level at which the measurement is triggered (see `TRIG:SEQ:SOUR`). The command is enabled for trigger source `RFPower` and `IFPower` only.	V2.80

DEFault:TRIGger[:SEQuence] <Enable> Default Settings

<Enable>	Description of parameters	Def. value	Def. unit	Unit ring
ON |	The parameters are set to their default values	ON	–	–
OFF	Some or all parameters differ from the default values			

Description of command	FW vers.
If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to their default values (the setting *OFF* has no effect). If used as a query the command returns whether all parameters are set to their default values *(ON)* or not *(OFF)*.	V2.80

Connection Control

The remote-control commands presented in this section determine the signals analyzed and generated by the CMU, the inputs and outputs used to this end as well as the reference frequency. They correspond to the settings in the popup menu of the softkey *Connect. Control*, located to the right of the headline of each main menu.

Subsystem RFANalyzer (Analyzed Input Signals)

The subsystem *RFANalyzer* contains the commands to determine the signals received and analyzed by the CMU. It corresponds to the panel *Analyzer Settings* in the tab *Signal* in the popup menu *Connect. Control*.

[SENSe:]RFANalyzer:FREQuency:UNIT *<Unit>*				Frequency Unit
<Unit>	Description of parameters	Def. value	Def. unit	Unit ring
Hz | KHZ | MHZ | GHZ | CH	Frequency unit Channel number	Hz	Hz	
Description of command				FW vers.
This command defines whether the frequency of the RF signal analyzed is specified in frequency units or as an GSM channel number. Frequency units must be used to select input signals that are outside the designated GSM channel range.				V2.80

[SENSe:]RFANalyzer:FREQuency *<Frequency>*				RF Channel
<Frequency>	Description of parameters	Def. value	Def. unit	Unit ring
0.2 MHz to 2700 MHz	Input frequency	467 000 000 (GSM400)	Hz	
(see also data sheet)	(in multiples of 200 kHz)	948 000 000 (GSM900)	Hz	
		1 842 000 000 (GSM1800)	Hz	
		1 960 000 000 (GSM1900)	Hz	
Description of command				FW vers.
This command defines the frequency of the RF signal analyzed. With the command `[SENSe:]RFANalyzer:FREQuency:UNIT`, the default frequency unit can be changed, and even GSM channel numbers can be entered instead of frequencies. In the latter case, the assignment of channel numbers and frequencies meets the specification for the downlink channel (signal direction from base station under test to CMU).				V2.80

[SENSe:]RFANalyzer:FOFFset *<FreqOffset>*				Frequency Offset
<FreqOffset>	Description of parameters	Def. value	Def. unit	Unit ring
–100 kHz to +100 kHz	Offset for channel frequency	0.0	Hz	–
Description of command				FW vers.
This command defines an offset shifting the channel frequency set with the command `[SENSe:]RFANalyzer:FREQuency <Number>`. The offset frequency must be in multiples of 1 Hz.				V2.80

[SENSe:]RFANalyzer:TSEQuence *<TrainingSequence>*				Training Sequence
<TrainingSequence>	Description of parameters	Def. value	Def. unit	Unit ring
OFF |	No training sequence detected	ANY	–	–
GSM0 to GSM7 |	GSM-specific training sequence			
DUMMy |	GSM dummy burst			
ANY	Arbitrary training sequence allowed			

Description of command	FW vers.
This command defines the training sequence of the signal to be analyzed. If no training sequence is specified *(OFF),* the CMU measures all signals. In the setting ANY, it uses any training sequence for synchronization.	V2.80

Generator Object "RFGenerator" – Generator control

The subsystem *RFGenerator* controls the internal RF generator. It corresponds to the softkey *RF Generator* in the tab *Signal* in the popup menu *Connect. Control* and the measurement menu *Analyzer/Generator.*

INITiate:RFGenerator	Start RF generator, reserve resources	*RUN*
ABORt:RFGenerator	Switch off RF generator, release resources	*OFF*

Description of command	FW vers.
These commands have no query form. They start and stop the RF generator, setting it to the status given in the top right column.	V2.80

FETCh:RFGenerator:STATus?				Generator Status
Return	Description of parameters	Def. value	Def. unit	Unit ring
OFF |	Generator switched off (`ABORt` or `*RST`)	OFF	–	–
RUN |	Running (`INITiate`)			
ERR	Switched off (could not be started)			

Description of command	FW vers.
This command is always a query. It returns the current generator status.	V2.80

Generator Level – Subsystem RFGenerator:LEVel

The subsystem *RFGenerator:LEVel* determines the level of the generated RF signals. It corresponds to the input field *RF Level* of the panel *RF Generator* in the tab *Signal* in the popup menu *Connect. Control.*

SOURce:RFGenerator:LEVel:UTIMeslot *<Level>*				RF Level used
<Level>	Description of parameters	Def. value	Def. unit	Unit ring
–137 dBm to –27 dBm	RF1 level in used timeslot	–80	dBm	–
–137 dBm to –10 dBm	RF2 level in used timeslot	–80	dBm	
–90 dBm to +13 dBm	RF 3 OUT level in used timeslot	–27	dBm	

Description of command	FW vers.
This command determines the RF generator level in the used timeslot. The permissible value range depends on the used RF output of the CMU and the external attenuation set (see `[SENSe:]CORRection:LOSS:OUTPut<nr>[:MAGNitude]` command).	V2.80

SOURce:RFGenerator:LEVel:UNTimeslot *<Level>*				RF Level unused
<Level>	Description of parameters	Def. value	Def. unit	Unit ring
–110 dB to 0 dB **–110 dB to 17 dB** **–63 dB to 40 dB**	Level in unused timeslots, RF 1 Level in unused timeslots, RF 2 Level in unused timeslots, RF 3 OUT	–30 –30 –30	dB dB dB	–
Description of command				FW vers.
This command determines the RF generator level in the unused timeslots relative to the level in the used timeslot.				V2.80

The level range quoted above applies if the RF level in the used timeslot (P^{used}) is at its default value. In general, the range for P^{unused} is adjusted such that the absolute level range in the unused timeslots corresponds to the range of the RF outputs, i.e. (in logarithmic units):

$$P^{unused}_{min} = P^{used}_{min} - P^{used}_{act}; \qquad P^{unused}_{max} = P^{used}_{max} - P^{used}_{act};$$

the indices *min, max, act* denoting the minimum and maximum level allowed and the actual level set.

RF Generator Frequency – Subsystem RFGenerator:FREQuency

The subsystem *RFGenerator:FREQuency* determines the frequency of the generated RF signals. It corresponds to the softkeys *RF Channel* and *Freq. Offset* of the panel *RF Generator* in the tab *Signal* in the popup menu *Connect. Control*.

SOURce:RFGenerator:FREQuency:UNIT *<Unit>*				Frequency Unit
<Unit>	Description of parameters	Def. value	Def. unit	Unit ring
Hz | KHZ | MHZ | GHZ | CH	Frequency unit | Channel number	Hz	Hz	
Description of command				FW vers.
This command defines whether the frequency of the RF signal generated is specified in frequency units or as a GSM channel number. Frequency units must be used to select input signals that are outside the designated GSM channel range.				V2.80

SOURce:RFGenerator:FREQuency *<Frequency>*				RF Channel
<Frequency>	Description of parameters	Def. value	Def. unit	Unit ring
0.2 MHz to 2700 MHz (see also data sheet)	Input frequency (in multiples of 200 Hz)	457 000 000(GSM400) 903 000 000 (GSM900) 1 747 000 000 (GSM 1800) 1 880 000 000 (GSM 1900)	Hz Hz Hz Hz	–
Description of command				FW vers.
This command defines the frequency of the RF signal generated. With the command `SOURce:RFGenerator:FREQuency:UNIT`, the default frequency unit can be changed, and even GSM channel numbers can be entered instead of frequencies. In the latter case, the assignment of channel numbers and frequencies meets the specification for the uplink channel (signal direction from CMU to base station under test).				V2.80

SOURce:RFGenerator:FOFFset <*FrequencyOffset*>				Frequency Offset
<FrequencyOffset>>	Description of parameters	Def. value	Def. unit	Unit ring
–100.0 kHz to +100.0 kHz	Frequency offset	0.0	Hz	Freq.
Description of command				FW vers.
This command determines a frequency offset for the CMU signals in the selected RF channel (with respect to the frequency specified in the GSM standard).				V2.80

Subsystem RFGenerator:MODulation

The subsystem *RFGenerator:MODulation* defines an information which is modulated on the RF signal generated by the CMU and the signal shape. It corresponds to the panel *Generator Modulation* in the tab *Signal* in the popup menu *Connect. Control*.

CONFigure:RFGenerator:MODulation:BMODulation <*Selection*>				Bit Modulation
<Selection>	Description of parameters	Def. value	Def. unit	Unit ring
OFF | **PRBS |** **DUMMy |** **ALL0 |** **EALL0** **EPRBs**	No modulation sequence Pseudo-random bit sequence GSM dummy bursts Modulation sequence consisting of zeros Zeros, in 8PSK modulation PRBS, in 8PSK modulation	ALL0	–	–
Description of command				FW vers.
The command selects a bit sequence used to modulate the signal generated by the CMU. The parameters `EALL0` and `EPRBS` are available with option CMU-K41 only.				V2.80

CONFigure:RFGenerator:MODulation:TSEQuence <*SELection*>				Training Sequence
<Selection>	Description of parameters	Def. value	Def. unit	Unit ring
ALL0 | **GSM0 to GSM7 |** **DUMMy**	Training sequence consisting of zeros GSM standard training sequences no. 0 to 7 GSM dummy burst	GSM0	–	–
Description of command				FW vers.
The command selects a training sequence used to modulate the signal generated by the CMU.				V2.80

CONFigure:RFGenerator:MODulation:TRANsmission <*Transmission*>				Transmission
<Transmission>	Description of parameters	Def. value	Def. unit	Unit ring
BURSt | **CONTinuous**	Bursted RF signal Continuous signal	BURSt	–	–
Description of command				FW vers.
This command determines whether the the CMU generates a bursted or a contiunuous RF carrier signal.				V2.80

Subsystem for RF Input and Output Connectors

The following commands configure the RF input and output connectors. The commands correspond to the tab *RF* ⚙ in the popup menu *Connect. Control*.

INPut[:STATe] *<State>* RF Input

<State>	Description of parameters	Def. value	Def. unit	Unit ring
RF1 | **RF2 |** **RF4**	Connector RF 1 used as input Connector RF 2 used as input Connector RF 4 IN used as input	RF2	–	–

Description of command	FW vers.
This command determines the connector to be used for incoming RF signals. The bidirectional connectors RF 1 and RF 2 can be used both as input and output connectors in the very same measurement (see `OUTPut[:STATe]`). Only one input and one output may be active at a time, which is why the currently active one is automatically deactivated on switchover.	V2.80

OUTPut[:STATe] *<State>* RF Output

<State>	Description of parameters	Def. value	Def. unit	Unit ring
RF1 | **RF2 |** **RF3**	Connector RF 1 used as output Connector RF 2 used as output Connector RF 3 OUT used as output	RF2	–	–

Description of command	FW vers.
This command determines the connector to be used for outgoing RF signals. The bidirectional connectors RF 1 and RF 2 can be used both as input and output connectors in the very same measurement. Only one input and one output may be active at a time, which is why the currently active one is automatically deactivated on switchover.	V2.80

[SENSe:]CORRection:LOSS:INPut<nr>[:MAGNitude] *<Absorption>*
SOURce:CORRection:LOSS:INPut<nr>[:MAGNitude] *<Absorption>* Ext. Att. Input

<Absorption>	Description of parameters	Def. value	Def. unit	Unit ring
–50 dB to +50 dB	Ext. attenuation at RF <nr>, where <nr> = 1 or 2	0.0	dB	–
–90 dB to +90 dB	Ext. attenuation at RF 4 IN	0.0	dB	–

Description of command	FW vers.
This command assigns an external attenuation value to the inputs of the instrument *(RF 1, RF 2, RF 4 IN)*.	V2.80

[SENSe:]CORRection:LOSS:OUTPut<nr>[:MAGNitude] *<Absorption>*
SOURce:CORRection:LOSS:OUTPut<nr>[:MAGNitude] *<Absorption>* Ext. Att. Output

<Absorption>	Description of parameters	Def. value	Def. unit	Unit ring
–50 dB to +50 dB	Ext. attenuation at RF <nr>, where <nr> = 1 or 2	0.0	dB	–
–90 dB to +90 dB	Ext. attenuation at RF 3 OUT	0.0	dB	–

Description of command	FW vers.
This command assigns an external attenuation value to the outputs of the instrument *(RF 1, RF 2, RF 3 OUT)*.	V2.80

Subsystem DM:CLOCk (Synchronization)

The subsystem *DM:CLOCk* sets a system clock specific to the network. This frequency is set in the tab *Synch.* in the popup menu *Connect. Control*.

SOURce:DM:CLOCk:STATe *<Mode>*				REF OUT 2
<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
ON | OFF	Switch on/off system clock	OFF	–	–
Description of command				FW vers.
This commands switches the system clock specific to the network at the *REF OUT 2* connector on or off.				V2.80

SOURce:DM:CLOCk:FREQuency *<Frequency>*				REF OUT 2
<Frequency>	Description of parameters	Def. value	Def. unit	Unit ring
1.2190 MHz to 39.000 MHz	Input value for reference frequency	13.000	MHz	
Description of command				FW vers.
This command defines the clock frequency applied to output *REF OUT 2*. The frequency entered is rounded to one of the following discrete values: 39.000 MHz, 19.500 MHz, 13.000 MHz, 9.750 MHz, 7.800 MHz, 6.500 MHz, 5.571 MHz, 4.875 MHz, 4.333 MHz, 3.900 MHz, 3.545 MHz, 3.250 MHz, 3.000 MHz, 2.786 MHz, 2.600 MHz, 2.438 MHz, 2.294 MHz, 2.166 MHz, 2.053 MHz, 1.950 MHz, 1.857 MHz, 1.773 MHz, 1.696 MHz, 1.625 MHz, 1.560 MHz, 1.500 MHz, 1.444 MHz, 1.393 MHz, 1.349 MHz, 1.300 MHz, 1.258 MHz, 1.219 MHz				V2.80

Test Object WPOWer

The subsystem *WPOWer* measures the power of the signal from the base transceiver station using a wide-band filter. It corresponds to the softkey *Power* of the tab *Signalling* in the menu group *Connect. Control* and the associated output field.

INITiate:WPOWer	Start new measurement	*RUN*
ABORt:WPOWer	Abort measurement and switch off	*OFF*
STOP:WPOWer	Stop measurement	*STOP*
CONTinue:WPOWer	Next measurement step (only *counting mode*)	*RUN*
Description of command		FW vers.
These commands have no query form. They start or stop the measurement, setting it to the status given in the top right column.		V2.80

CONFigure:WPOWer:EREPorting *<Mode>*				Event Reporting
<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
SRQ |	Service request	OFF	–	
SOPC |	Single operation complete			
SRSQ |	SRQ and SOPC			
OFF	No reporting			
Description of command				FW vers.
This command defines the events generated when the measurement is terminated or stopped *(event reporting*, see chapter 5).				V2.80

FETCh:WPOWer:STATus?				Measurement Status
Return	Description of parameters	Def. value	Def. unit	Unit ring
OFF |	Measurement in the *OFF* state (`*RST` or `ABORt`)	OFF	–	–
RUN |	Running (after `INITiate`, `CONTinue` or `READ`)			
STOP |	Stopped (`STOP`)			
ERR |	*OFF* (could not be started)			
STEP |	Stepping mode *(<stepmode>=STEP)*			
RDY,	Stopped according to repetition mode and stop condition			
1 to 10000 |	Counter for current statistics cycle			
NONE	No counting mode set	NONE	–	–
Description of command				FW vers.
This command is always a query. It returns the status of the measurement (see chapters 3 and 5).				V2.80

CONFigure:WPOWer:CONTrol:REPetition *<Repetition>,<StopCond>,<Stepmode>* Test Cycles

<Repetition>	Description of parameters	Def. value	Def. unit	Unit ring
CONTinuous | **SINGleshot |** **1 to 10000,**	Continuous measurement (until `STOP` or `ABORT`) Single shot measurement (until `Status = RDY`) Multiple measurement (*counting*, until `Status = STEP | RDY`)	SING	–	–
<StopCond>	Description of parameters	Def. value	Def. unit	Unit ring
SOERror | **NONE,**	Start measurement in case of error *(stop on error)* Continue measurement even in case of error	NONE	–	–
<Stepmode>	Description of parameters	Def. value	Def. unit	Unit ring
STEP | **NONE**	Interrupt measurement after each statistics cycle Continue measurement according to its rep. mode	NONE	–	–

Description of command	FW vers.
This command determines the number of statistics cycles, the stop condition and the stepping mode for the measurement. **Note:** *In the case of READ commands (`READ:...`), the <Repetition> parameter has no effect; the measurement is always stopped after a single shot.*	V2.80

READ[:SCALar]:WPOWer? Start single shot measurement and return results
FETCh[:SCALar]:WPOWer? Read out measurement results (unsynchronized)
SAMPle[:SCALar]:WPOWer? Read out measurement results (synchronized)

Return	Description of parameters	Def. value	Def. unit	Unit ring
–100.0 dBm to +53.0 dBm	Maximum burst power (not averaged)	NAN	dBm	

Description of command	FW vers.
These commands are always queries. They start the measurement of the maximum burst power of the signals sent by the base station `(READ...)` and output the result.	V2.80

Test Object POWer

The subsystem *POWer* measures the signal power. The subsystem corresponds to the measurement menu *Power* and the associated popup menu *Power Configuration.*

Important Note!

> *The keywords* `:GMSK` *and* `:EPSK` *in the remote control commands denote GMSK and 8PSK modulation, respectively. The* `:EPSK` *commands are available with option CMU-K41 only.*

Control of measurement – Subsystem Power

The subsystem *POWer* controls the power measurement.

INITiate:POWer:NBURst:GMSK **INITiate:POWer:NBURst:EPSK**	Start new measurement	RUN
ABORt:POWer:NBURst:GMSK **ABORt:POWer:NBURst:EPSK**	Abort running measurement and switch off	OFF
STOP:POWer:NBURst:GMSK **STOP:POWer:NBURst:EPSK**	Stop measurement after current stat. cycle	STOP
CONTinue:POWer:NBURst:GMSK **CONTinue:POWer:NBURst:EPSK**	Next measurement step (only stepping mode)	RUN

Description of command	FW vers.
These commands have no query form. They start and stop the power measurement, setting it to the status indicated in the top right column.	V2.80

CONFigure:POWer:NBURst:GMSK:EREPorting *<Mode>*
CONFigure:POWer:NBURst:EPSK:EREPorting *<Mode>* Event Reporting

<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
SRQ |	Service request	OFF	–	–
SOPC |	Single operation complete			
SRSQ |	SRQ and SOPC			
OFF	No reporting			

Description of command	FW vers.
This command defines the events generated when the measurement is terminated or stopped (event reporting, see chapter 5 of CMU200 manual).	V2.80

FETCh:POWer:NBURst:GMSK:STATus?
FETCh:POWer:NBURst:EPSK:STATus? Measurement Status

Return	Description of parameters	Def. value	Def. unit	Unit ring
OFF |	Measurement in the *OFF* state (`*RST` or `ABORt`)	OFF	–	–
RUN |	Running (after `INITiate`, `CONTinue` or `READ`)			
STOP |	Stopped (`STOP`)			
ERR |	*OFF* (could not be started)			
STEP |	Stepping mode *(<stepmode>=STEP)*			
RDY,	Stopped according to repetition mode and stop condition			
1 to 10000 |	Counter for current statistics cycle	NONE	–	–
NONE,	No counting mode set			
1 to 1000 |	Counter for current evaluation period within a cycle	NONE	–	–
NONE	Statistic count set to off			

Description of command	FW vers.
This command is always a query. It returns the status of the measurement (see chapters 3 and 5).	V2.80

Subsystem POWer:NBURst...:CONTrol

The subsystem *POWer:NBURst...:CONTrol* defines the repetition mode, statistic count, and stop condition of the measurement. These settings are provided in the *Control* and *Statistics* tabs in the popup menu *Power Configuration.*

CONFigure:POWer:NBURst:GMSK:CONTrol *<Mode>, <Statistics>, <Repetition>, <StopCond>, <Stepmode>* Scope of Measurement
CONFigure:POWer:NBURst:EPSK:CONTrol *<Mode>, <Statistics>, <Repetition>, <StopCond>, <Stepmode>*

<Mode>	Desciption of parameters	Def. value	Def. unit	Unit ring
SCALar |	Scalar values only (incl. ramp matching)	ARRay	–	–
ARRay,	Scalar measured values and arrays			

<Statistics>	Description of parameters	Def. value	Def. unit	Unit ring
1 to 1000 |	Number of bursts per statistics cycle	100	–	–
NONE	Statistics off (equivalent to 1)			

<Repetition>	Description of parameters	Def. value	Def. unit	Unit ring
CONTinuous |	Continuous measurement (until `STOP` or `ABORT`)	SING	–	–
SINGleshot |	Single shot measurement (until `Status = RDY`)			
1 to 10000,	Multiple measurement (*counting*, until `Status = STEP | RDY`)			

<StopCond>	Description of parameters	Def. value	Def. unit	Unit ring
SOERror |	Stop measurement in case of error *(stop on error)*	NONE	–	–
NONE,	Continue measurement even in case of error			

<Stepmode>	Description of parameters	Def. value	Def. unit	Unit ring
STEP |	Interrupt measurement after each statistics cycle	NONE	–	–
NONE	Continue measurement according to its rep. mode			

Description of command	FW-Vers.
This command defines the scope of the power measurement, combining the `...CONTrol:RMODe`, `...CONTrol:STATistics`, and the `...CONTrol: REPetition` commands (see below).	V2.80

CONFigure:POWer:NBURst:GMSK:CONTrol:RMODe *<Mode>*
CONFigure:POWer:NBURst:EPSK:CONTrol:RMODe *<Mode>* Result Mode

<Mode>	Desciption of parameters	Def. value	Def. unit	Unit ring
SCALar |	Scalar values only (incl. ramp matching)	ARRay	–	–
ARRay,	Scalar measured values and arrays			

Description of command	FW-Vers.
This command specifies the type of measured values.	V2.80

CONFigure:POWer:NBURst:GMSK:CONTrol:STATistics *<Statistics>*
CONFigure:POWer:NBURst:EPSK:CONTrol:STATistics *<Statistics>* Statistics Count

<Statistics>	Description of parameters	Def. value	Def. unit	Unit ring
1 to 1000 |	Number of bursts per statistics cycle	100	–	–
NONE	Statistics off (equivalent to 1)			

Description of command	FW-Vers.
This command defines the number of bursts forming a statistics cycle.	V2.80

CONFigure:POWer:NBURst:GMSK:CONTrol:REPetition
CONFigure:POWer:NBURst:EPSK:CONTrol:REPetition
<Repetition>,<StopCond>,<Stepmode> Test cycles

<Repetition>	Description of parameters	Def. value	Def. unit	Unit ring
CONTinuous |	Continuous measurement (until `STOP` or `ABORT`)	SING	–	–
SINGleshot |	Single shot measurement (until `Status = RDY`)			
1 to 10000,	Multiple measurement (*counting*, until `Status = STEP | RDY`)			
<StopCond>	Description of parameters	Def. value	Def. unit	Unit ring
SOERror |	Stop measurement in case of error *(stop on error)*	NONE	–	–
NONE,	Continue measurement even in case of error			
<Stepmode>	Description of parameters	Def. value	Def. unit	Unit ring
STEP |	Interrupt measurement after each statistics cycle	NONE	–	–
NONE	Continue measurement according to its rep. mode			

Description of command	FW vers.
This command determines the number of statistics cycles, the stop condition and the stepping mode for the measurement. **Note:** *In the case of READ commands (`READ:...`), the <Repetition> parameter has no effect; the measurement is always stopped after a single shot.*	V2.80

DEFault:POWer:NBURst:GMSK:CONTrol <Enable>
DEFault:POWer:NBURst:EPSK:CONTrol <Enable>
Default Settings

<Enable>	Description of parameters	Def. value	Def. unit	Unit ring
ON | **OFF**	All parameters are set to their default values Some or all parameters differ from the default values	ON	–	–

Description of command	FW vers.
If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to their default values (the setting *OFF* has no effect). If used as a query the command returns whether all parameters are set to their default values *(ON)* or not *(OFF).*	V2.80

Test Configuration

The commands of the following subsystems determine the parameters of the signal power measurement. For a detailed explanation of the power tolerance template defined in the GSM standard see chapter 4.

Subsystem POWer:NBURst...:LIMit:LINE

The subsystem *POWer:NBURst...:LIMit:LINE* defines the limit lines and tolerance values for the power measurement. The subsystem corresponds to the tab *Limit Lines* in the popup menu *Power Configuration.*

CONFigure:POWer:NBURst:GMSK:LIMit:LINE:ASYMmetric:UPPer:AREA<nr> Upper Limit Line
CONFigure:POWer:NBURst:EPSK:LIMit:LINE:ASYMmetric:UPPer:AREA<nr>
<StartTime>, <EndTime>, <StartRelLevel>, <EndRelLevel>,
<StartAbsLevel>, <EndAbsLevel>, <Visibility>

CONFigure:POWer:NBURst:GMSK:LIMit:LINE:ASYMmetric:UPPer:AREA<nr>:ENABle
CONFigure:POWer:NBURst:EPSK:LIMit:LINE:ASYMmetric:UPPer:AREA<nr>:ENABle
<Enable>

CONFigure:POWer:NBURst:GMSK:LIMit:LINE:ASYMmetric:UPPer:AREA<nr>:VALue
CONFigure:POWer:NBURst:EPSK:LIMit:LINE:ASYMmetric:UPPer:AREA<nr>:VALue
<StartTime>, <EndTime>, <StartRelLevel>, <EndRelLevel>,
<StartAbsLevel>, <EndAbsLevel>

Parameters	Value range	Description of parameters	Def. unit
<Enable>	ON | OFF	Definition section on/off	See below
<StartTime>,	–10 bit/symb. to 157.25 bit/symb. | OFF	Start point of time	
<EndTime>,	–10 bit/symb. to 157.25 bit/symb. | OFF	End point of time	
<StartRelLevel>,	–100 dB to 10 dB | OFF,	Start point of level (relative)	
<EndRelLevel>,	–100 dB to 10 dB | OFF,	End point of level (relative)	
<StartAbsLevel>,	–90 dBm to 30 dBm | OFF,	Start point of level (absolute)	
<EndAbsLevel>,	–90 dBm to 30 dBm | OFF,	End point of level (absolute)	
<Visibility>	ON | OFF	Range of limit lines on/off	

Description of command	FW vers.
These commands activate and define upper limit lines for normal bursts. The limit lines are defined area by area; the suffix <nr> numbers the various areas in the burst diagram (see chapter 4).	V2.80

8 areas are defined in the default setting, another 8 areas can be activated if required. The default settings for GSM400/900/1800 at GMSK modulation in the defined areas are given in the table below:

	for Enable	forTable						
Suffix	Enable	Start Time / [bit]	Stop Time / [bit]	Start rel.Level	Stop rel.Level	Start abs.Level	Stop abs.Level	Visibility
1	ON	–10.00	–7.25	–30.0 dB	–30.0 dB	OFF	OFF	ON
2	ON	–7.25	–4.50	–30.0 dB	–30.0 dB	OFF	OFF	ON
3	ON	–4.50	–2.25	–6.0 dB	–6.0 dB	OFF	OFF	ON
4	ON	–2.25	0.50	+4.0 dB	+4.0 dB	OFF	OFF	ON
5	ON	0.50	150.25	+1.0 dB	+1.0 dB	OFF	OFF	ON
6	ON	150.25	152.50	–6.0 dB	–6.0 dB	OFF	OFF	ON
7	ON	152.50	155.25	–30.0 dB	–30.0 dB	OFF	OFF	ON
8	ON	155.25	157.00	–30.0 dB	–30.0 dB	OFF	OFF	ON

The setting *Visibility = Off* implies that the corresponding range, including the limit check, is switched off. The setting *Enable = Off* switches off the entire limit check.

The default settings for GSM1900 at GMSK modulation in the defined areas are given in the table below:

	for Enable	forTable						
Suffix	Enable	Start Time / [bit]	Stop Time / [bit]	Start rel.Level	Stop rel.Level	Start abs.Level	Stop abs.Level	Visibility
1	ON	–10.00	–7.25	–30.0 dB	–30.0 dB	OFF	OFF	ON
2	ON	–7.25	–4.50	–30.0 dB	–30.0 dB	OFF	OFF	ON
3	ON	–4.50	–2.25	–30.0 dB	0.0 dB	OFF	OFF	ON
4	ON	–2.25	0.50	+4.0 dB	+4.0 dB	OFF	OFF	ON
5	ON	0.50	150.25	+1.0 dB	+1.0 dB	OFF	OFF	ON
6	ON	150.25	152.50	0.0 dB	–30.0 dB	OFF	OFF	ON
7	ON	152.50	155.25	–30.0 dB	–30.0 dB	OFF	OFF	ON
8	ON	155.25	157.00	–30.0 dB	–30.0 dB	OFF	OFF	ON

The default settings for all GSM bands at 8PSK modulation in the defined areas are given in the table below:

	for Enable	forTable						
Suffix	Enable	Time / [symb]	Time / [symb]	Start rel.Level	Stop rel.Level	Start abs.Level	Stop abs.Level	Visibility
1	ON	–10.00	–7.00	–30.0 dB	–30.0 dB	OFF	OFF	ON
2	ON	–7.00	–4.50	–30.0 dB	–30.0 dB	OFF	OFF	ON
3	ON	–4.50	–2.25	–6.0 dB	–6.0 dB	OFF	OFF	ON
4	ON	–2.25	0.50	+4.0 dB	+4.0 dB	OFF	OFF	ON
5	ON	0.50	1.5	+2.4 dB	+2.4 dB	OFF	OFF	ON
6	ON	1.50	146.5	+4.0 dB	+4.0 dB	OFF	OFF	ON
7	ON	146.50	147.5	+2.4 dB	+2.4 dB	OFF	OFF	ON
8	ON	147.50	150.25	+4.0 dB	+4.0 dB	OFF	OFF	ON
9	ON	150.25	152.50	–6.0 dB	–6.0 dB	OFF	OFF	ON
10	ON	152.50	155.00	–30.0 dB	–30.0 dB	OFF	OFF	ON
11	ON	155.00	157.00	–30.0 dB	–30.0 dB	OFF	OFF	ON

```
CONFigure:POWer:NBURst:GMSK:LIMit:LINE:ASYMmetric:LOWer:AREA<nr> Lower Limit Line
CONFigure:POWer:NBURst:EPSK:LIMit:LINE:ASYMmetric:LOWer:AREA<nr>
        <StartTime>, <EndTime>, <StartRelLevel>, <EndRelLevel>,
        <StartAbsLevel>, <EndAbsLevel>, <Visibility>

CONFigure:POWer:NBURst:GMSK:LIMit:LINE:ASYMmetric:LOWer:AREA<nr>:ENABle
CONFigure:POWer:NBURst:EPSK:LIMit:LINE:ASYMmetric:LOWer:AREA<nr>:ENABle
        <Enable>

CONFigure:POWer:NBURst:GMSK:LIMit:LINE:ASYMmetric:LOWer:AREA<nr>:VALue
CONFigure:POWer:NBURst:EPSK:LIMit:LINE:ASYMmetric:LOWer:AREA<nr>:VALue
        <StartTime>, <EndTime>, <StartRelLevel>, <EndRelLevel>,
        <StartAbsLevel>, <EndAbsLevel>
```

Parameters	Value range	Description of parameters	Def. value
<Enable>	ON | OFF	Definition section on/off	See below
<StartTime>,	–10 bit/symb. to 157.25 bit/symb. | OFF	Start point of time	
<EndTime>,	–10 bit/symb. to 157.25 bit/symb. | OFF	End point of time	
<StartRelLevel>,	–100 dB to 10 dB | OFF,	Start point of level (relative)	
<EndRelLevel>,	–100 dB to 10 dB | OFF,	End point of level (relative)	
<StartAbsLevel>,	–90 dBm to 30 dBm | OFF,	Start point of level (absolute)	
<EndAbsLevel>,	–90 dBm to 30 dBm | OFF,	End point of level (absolute)	
<Visibility>	ON | OFF	Range of limit lines on/off	

Description of command	FW vers.
These commands activate and define lower limit lines for normal bursts. The limit lines are defined area by area; the suffix <nr> numbers the various areas in the burst diagram (see chapter 4).	V2.80

Only 1 area is defined in the default setting, another 15 areas can be activated if required. The default settings for all GSM bands at GMSK modulation in the defined areas are given in the table below:

	forEnable	forTable						
Suffix	Enable	Start Time / [bit]	Stop Time / [bit]	Start rel.Level	Stop rel.Level	Start abs.Level	Stop abs.Level	Visibility
1	ON	–10.00	0.50	OFF	OFF	OFF	OFF	ON
2	ON	0.50	147.50	–1.0 dB	–1.0 dB	OFF	OFF	ON
3	ON	147.50	157.00	OFF	OFF	OFF	OFF	ON

The default settings for all GSM bands at 8PSK modulation in the defined areas are given in the table below:

	for Enable	forTable						
Suffix	Enable	Start Time / [symb]	Stop Time / [symb]	Start rel.Level	Stop rel.Level	Start abs.Level	Stop abs.Level	Visibility
1	ON	–10.00	0.50	OFF	OFF	OFF	OFF	ON
2	ON	0.50	1.0	–2.0 dB	–2.0 dB	OFF	OFF	ON
3	ON	1.0	1.5	0.0 dB	0.0 dB	OFF	OFF	ON
4	ON	1.50	146.50	–15.0 dB	–15.0 dB	OFF	OFF	ON
7	ON	146.50	147.00	0.0 dB	0.0 dB	OFF	OFF	ON
8	ON	147.00	147.50	–2.0 dB	–2.0 dB	OFF	OFF	ON
7	ON	147.50	157.00	OFF	OFF	OFF	OFF	ON

CONFigure:POWer:NBURst:GMSK:LIMit:LINE:ASYMmetric:UPPer:ENABle *<Mode>*
Upper Limit Line on/off
CONFigure:POWer:NBURst:EPSK:LIMit:LINE:ASYMmetric:UPPer:ENABle *<Mode>*

<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
ON |	Switch on upper limit lines	ON	–	
OFF	Switch off upper limit lines			

Description of command	FW vers.
This command switches the upper limit lines in all areas on or off.	V2.80

CONFigure:POWer:NBURst:GMSK:LIMit:LINE:ASYMmetric:LOWer:ENABle *<Mode>*
Lower Limit Line on/off
CONFigure:POWer:NBURst:EPSK:LIMit:LINE:ASYMmetric:LOWer:ENABle *<Mode>*

<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
ON |	Switch on lower limit lines	ON	–	
OFF	Switch off lower limit lines			

Description of command	FW vers.
This command switches the lower limit lines in all areas on or off.	V2.80

DEFault:POWer:NBURst:GMSK:LIMit:LINE <Enable>
Default Settings
DEFault:POWer:NBURst:EPSK:LIMit:LINE <Enable>

<Enable>	Description of parameters	Def. value	Def. unit	Unit ring
ON |	All parameters are set to their default values	ON	–	–
OFF	Some or all parameters differ from the default values			

Description of command	FW vers.
If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to their default values (the setting *OFF* has no effect). If used as a query the command returns whether all parameters are set to their default values *(ON)* or not *(OFF)*.	V2.80

Subsystem POWer:NBURst...:TIME

The subsystem *POWer:NBURst...:TIME* contains the command for shifting the burst relative to the time axis (and thus the tolerance template). The subsystem corresponds to the popup window *Time - Mode* in the graphical measurement menu *Power*.

CONFigure:POWer:NBURst:GMSK:TIME:BOFFset *<Offset>*
Bit Offset
CONFigure:POWer:NBURst:EPSK:TIME:BOFFset *<Offset>*

<Offset>	Description of parameters	Def. value	Def. unit	Unit ring
–4.00 to +4.00	Number of bits (GMSK) or symbols (8PSK)	0	(bit/symb)	

Description of command	FW vers.
This command defines an offset time in ¼ bit/symbol units by which the burst is shifted relative to the time axis and the tolerance template.	V2.80

Subsystem POWer:NBURst...:RPMode

The subsystem *POWer:NBURst...:RPMode* contains the command determining the way how the reference power is calculated in 8PSK modulation. The subsystem corresponds to the *Ref. Power Mode* parameter in the *Control* tab of the *Power Configuration* menu.

CONFigure:POWer:NBURst:EPSK:RPMode <*Mode*>				Ref. Power Mode
<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
CURRent | **AVERage |** **DCOMpens**	Ref. Power calculated from current burst Ref. Power calculated from average curve Data compensated/corrected reference power	CURR	–	
Description of command				FW vers.
This command determines how the reference power (0-dB line in the *P/t Norm. 8PSK* test diagram) for 8PSK-modulated signals is calculated.				V2.80

Subsystem SUBarrays:POWer

The subsystem *SUBarrays:POWer* defines the measurement range and the type of output values.

CONFigure:SUBarrays:POWer:NBURst:GMSK **CONFigure:SUBarrays:POWer:NBURst:EPSK** **<Mode>,<Start>,<Samples>{,<Start>,<Samples>}**				Definition of Subarrays
<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
ALL | **ARIThmetical |** **MINimum |** **MAXimum,**	Return all measurement values Return arithm. mean value in every range Return minimum value in every range Return maximum value in every range	ALL	–	
<Start>	Description of parameters	Def. value	Def. unit	Unit ring
–10 bit to 156 ¾ bit,	Start time in current range (in bit for GMSK, symbols for 8PSK modulation)	–10	bit / symb	
<Samples>	Description of parameters	Def. value	Def. unit	Unit ring
0 to 668	Number of samples in current range	668	–	
Description of command				FW vers.
This command configures the `READ:SUBarrays:POWer...`, `FETCh:SUBarrays:POWer...`, and `SAMPle:SUBarrays:POWer` commands. It restricts the measurement to up to 32 subranges where either all measurement results (the number of which is given by the second numerical parameter) or a single statistical value is returned. The subranges are defined by the start time and the number of test points which are located on a fixed, equidistant grid with a step width of ¼ bit. The subranges may overlap but must be within the total range of the *POWer* measurement. Test points outside this range are not measured (result *NAN)* and do not enter into the ARIThmetical, MINimum and MAXimum values. By default, only one range corresponding to the total measurement range is used and all measurement values are returned.				V2.80

Measured Values – Subsystem POWer:NBURst...

The subsystem *POWer:NBURst...* determines and outputs the results of the signal power measurement. They correspond to the graphical measurement menu *Power* with its various display elements.

READ[:SCALar]:POWer:NBURst:GMSK? **READ[:SCALar]:POWer:NBURst:EPSK?**	Scalar results: Start single shot measurement and return results
FETCh[:SCALar]:POWer:NBURst:GMSK? **FETCh[:SCALar]:POWer:NBURst:EPSK?**	Read out measurement results (unsynchronized)
SAMPle[:SCALar]:POWer:NBURst:GMSK? **SAMPle[:SCALar]:POWer:NBURst:EPSK?**	Read out measurement results (synchronized)

Return	Value range	Def. value	Def. unit	Unit ring
BurstsOutOfTol,	0.0 % to 100.0 %	NAN	%	–
AvgBurstPower,	–100.0 dBm to +20.0 dBm	NAN	dBm	
PeakBurstPower,	–100.0 dBm to +20.0 dBm	NAN	dBm	
BurstMatching,	MATC | NMAT | INV | NTSC | OUT | NTRG | UFLW | OFLW	INV	–	
AvgBurstPwAverage	–100.0 dBm to +20.0 dBm	NAN	dBm	

Description of command	FW vers.
These commands are always queries. They start a measurement and output all scalar measurement results (see chapter 5). The results are:	V2.80

Bursts out of tolerance (percentage)
Average power of current burst
Peak power of current burst
Average power of averaged trace *Burst template matching*

The calculation of results in an *average* or *peak* measurement is described in chapter 3 (cf. *display modes*).The following messages may be output for the value *BurstMatching*:

MATC	*matching*
NMAT	*not matching*
INV	*invalid*
NTSC	*no training sequence code*
OUT	*out of range*
NTRG	*not triggered*
UFLW	*underflow*
OFLW	*overflow*

CALCulate[:SCALar]:POWer:NBURst:GMSK:MATChing:LIMit? **CALCulate[:SCALar]:POWer:NBURst:EPSK:MATChing:LIMit?**	Limit Matching

Return	Value range	Def. value	Def. unit	Unit ring
AvgBurstPower,	NMAU | NMAL | INV | OK	INV	–	
PeakBurstPower,	NMAU | NMAL | INV | OK	INV	–	
BurstMatching,	MATC | NMAT | INV | NTSC | OUT | NTRG | UFLW | OFLW	INV	–	
AvgBurstPwAverage	NMAU | NMAL | INV | OK	INV	–	

Description of command	FW vers.
This command is always a query. It indicates whether and in which way the permissible tolerances for the scalar measured values (see command above) have been exceeded. The following messages may be output for the values *AvgBurstPower and PeakBurst-Power*: NMAU Tolerance value underflow *not matching, underflow* NMAL Tolerance value exceeded *not matching, overflow* INV Measurement invalid *invalid* OK Tolerance value matched The following messages may be output for the value *BurstMatching*: MATC *matching* NMAT *not matching* INV *invalid* NTSC *no training sequence code* OUT *out of range* NTRG *not triggered* UFLW *underflow* OFLW *overflow*	V2.80

READ:ARRay:POWer:NBURst:GMSK:CURRent? Burst Power
READ:ARRay:POWer:NBURst:EPSK:CURRent?
READ:ARRay:POWer:NBURst:GMSK:AVERage?
READ:ARRay:POWer:NBURst:EPSK:AVERage?
READ:ARRay:POWer:NBURst:GMSK:MAXimum?
READ:ARRay:POWer:NBURst:EPSK:MAXimum?
READ:ARRay:POWer:NBURst:GMSK:MINimum?
READ:ARRay:POWer:NBURst:EPSK:MINimum?
Start single shot measurement and return results *RUN*

FETCh:ARRay:POWer:NBURst:GMSK:CURRent?
FETCh:ARRay:POWer:NBURst:EPSK:CURRent?
FETCh:ARRay:POWer:NBURst:GMSK:AVERage?
FETCh:ARRay:POWer:NBURst:EPSK:AVERage?
FETCh:ARRay:POWer:NBURst:GMSK:MAXimum?
FETCh:ARRay:POWer:NBURst:EPSK:MAXimum?
FETCh:ARRay:POWer:NBURst:GMSK:MINimum?
FETCh:ARRay:POWer:NBURst:EPSK:MINimum?
Read meas. results (unsynchronized) *RUN*

SAMPle:ARRay:POWer:NBURst:GMSK:CURRent?
SAMPle:ARRay:POWer:NBURst:EPSK:CURRent?
SAMPle:ARRay:POWer:NBURst:GMSK:AVERage?
SAMPle:ARRay:POWer:NBURst:EPSK:AVERage?
SAMPle:ARRay:POWer:NBURst:GMSK:MAXimum?
SAMPle:ARRay:POWer:NBURst:EPSK:MAXimum?
SAMPle:ARRay:POWer:NBURst:GMSK:MINimum?
SAMPle:ARRay:POWer:NBURst:EPSK:MINimum?
Read results (synchronized) *RUN*

Return	Description of parameters	Def. value	Def. unit	Unit ring
–100 dB to + 20.0 dB,	BurstPower[1],	NAN	dB	
…,	…	…	…	
–100 dB to + 20.0 dB	BurstPower[668],	NAN	dB	

Description of command	FW vers.
These commands are always queries. They output the burst power versus time in a fixed ¼- bit pattern. The number of measured values is 668, corresponding to a time range of –10 bit to +156¾ bit. The calculation of results in the modes *current, average, maximum* and *minimum* is explained in chapter 3 (cf. *display modes*).	V2.80

READ:SUBarrays:POWer:NBURst:GMSK:CURRent? Subarray Results
READ:SUBarrays:POWer:NBURst:EPSK:CURRent?
READ:SUBarrays:POWer:NBURst:GMSK:AVERage?
READ:SUBarrays:POWer:NBURst:EPSK:AVERage?
READ:SUBarrays:POWer:NBURst:GMSK:MAXimum?
READ:SUBarrays:POWer:NBURst:EPSK:MAXimum?
READ:SUBarrays:POWer:NBURst:GMSK:MINimum?
READ:SUBarrays:POWer:NBURst:EPSK:MINimum?
Start single shot measurement and return results *RUN*
FETCh:SUBarrays:POWer:NBURst:GMSK:CURRent?
FETCh:SUBarrays:POWer:NBURst:EPSK:CURRent?
FETCh:SUBarrays:POWer:NBURst:GMSK:AVERage?
FETCh:SUBarrays:POWer:NBURst:EPSK:AVERage?
FETCh:SUBarrays:POWer:NBURst:GMSK:MAXimum?
FETCh:SUBarrays:POWer:NBURst:EPSK:MAXimum?
FETCh:SUBarrays:POWer:NBURst:GMSK:MINimum?
FETCh:SUBarrays:POWer:NBURst:EPSK:MINimum?
Read meas. results (unsynchronized) *RUN*
SAMPle:SUBarrays:POWer:NBURst:GMSK:CURRent?
SAMPle:SUBarrays:POWer:NBURst:EPSK:CURRent?
SAMPle:SUBarrays:POWer:NBURst:GMSK:AVERage?
SAMPle:SUBarrays:POWer:NBURst:EPSK:AVERage?
SAMPle:SUBarrays:POWer:NBURst:GMSK:MAXimum?
SAMPle:SUBarrays:POWer:NBURst:EPSK:MAXimum?
SAMPle:SUBarrays:POWer:NBURst:GMSK:MINimum?
SAMPle:SUBarrays:POWer:NBURst:EPSK:MINimum?
Read results (synchronized) *RUN*

Ret. values per subrange	Description of parameters	Def. value	Def. unit	Unit ring
–100 dB to + 20.0 dB,	BurstPower[1],	NAN	dB	
...,	...	...	...	
–100 dB to + 20.0 dB	BurstPower[n]	NAN	dB	

Description of command	FW vers.
These commands are always queries. They output the burst power versus time in a fixed ¼-bit pattern and in the subranges defined by means of the `CONFigure:SUBarrays:POWer` command. In the default setting of the configuration command the `READ:SUBarrays...`, `FETCh:SUBarrays...`, and `SAMPle:SUBarrays...` command group is equivalent to the `READ:ARRay...`, `FETCh:ARRay...`, and `SAMPle:ARRay...` command group described above. The `CONFigure:SUBarrays:POWer` command defines a maximum of 32 subranges. If one of the statistical modes `(ARIThmetical, MINimum, MAXimum)` is set, only one value is returned per subrange. The calculation of *current, average, minimum,* and *maximum* results is explained in chapter 3 (cf. *display mode*).	V2.80

```
CALCulate:ARRay:POWer:NBURst:GMSK:CURRent:MATChing:LIMit?
CALCulate:ARRay:POWer:NBURst:EPSK:CURRent:MATChing:LIMit?

CALCulate:ARRay:POWer:NBURst:GMSK:AVERage:MATChing:LIMit?
CALCulate:ARRay:POWer:NBURst:EPSK:AVERage:MATChing:LIMit?

CALCulate:ARRay:POWer:NBURst:GMSK:MAXimum:MATChing:LIMit?
CALCulate:ARRay:POWer:NBURst:EPSK:MAXimum:MATChing:LIMit?

CALCulate:ARRay:POWer:NBURst:GMSK:MINimum:MATChing:LIMit?
CALCulate:ARRay:POWer:NBURst:EPSK:MINimum:MATChing:LIMit?
```

Burst Matching

Return	Value range	Def. value	Def. unit	Unit ring
Matching	MATC | NMAT | INV | NTSC | OUT | NTRG | UFLW | OFLW	INV	–	–

Description of command	FW vers.
This command is always a query. It indicates whether and in which way the permissible tolerances for the burst power (see preceding command) have been exceeded.	V2.80

The following messages may be output for the measured value *Matching*:

MATC	*matching*
NMAT	*not matching*
INV	*invalid*
NTSC	*no training sequence code*
OUT	*out of range*
NTRG	*not triggered*
UFLW	*underflow*
OFLW	*overflow*

```
CALCulate:ARRay:POWer:NBURst:GMSK:CURRent:MATChing:AREA?
CALCulate:ARRay:POWer:NBURst:EPSK:CURRent:MATChing:AREA?
CALCulate:ARRay:POWer:NBURst:GMSK:AVERage:MATChing:AREA?
CALCulate:ARRay:POWer:NBURst:EPSK:AVERage:MATChing:AREA?
CALCulate:ARRay:POWer:NBURst:GMSK:MAXimum:MATChing:AREA?
CALCulate:ARRay:POWer:NBURst:EPSK:MAXimum:MATChing:AREA?
CALCulate:ARRay:POWer:NBURst:GMSK:MINimum:MATChing:AREA?
CALCulate:ARRay:POWer:NBURst:EPSK:MINimum:MATChing:AREA?
```

Range Violation

Return	Description of parameters	Def. value	Def. unit	Unit ring
32 bit field,	Indicator for upper limit matching in area 1 to 16 (16 least significant bits),	NAN	–	–
32 bit field	Indicator for lower limit matching in area 1 to 16 (16 least significant bits)	NAN	–	–

Description of command	FW vers.
This command is always a query. Any bit of the two returned fields that is set indicates that the corresponding area of the limit lines is violated.	V2.80

MODulation:PERRor

The subsystem *MODulation:PERRor:GMSK* measures the modulation parameters (frequency and phase errors) in GMSK modulation. The subsystem corresponds to the measurement menu *Modulation,* application *Phase Error GMSK,* and the associated popup menu *Modulation Configuration.*

Control of Measurement

The subsystem *MODulation:PERRor:GMSK* controls the modulation measurement. It corresponds to the softkey *Phase Err. GMSK* in the measurement menu *Modulation.*

INITiate:MODulation:PERRor:GMSK	Start new measurement	*RUN*
ABORt:MODulation:PERRor:GMSK	Abort running measurement and switch off	*OFF*
STOP:MODulation:PERRor:GMSK	Stop measurement after current stat. cycle	*STOP*
CONTinue:MODulation:PERRor:GMSK	Next measurement step (only *stepping mode*)	*RUN*
Description of command		FW vers.
These commands have no query form. They start and stop the modulation measurement, setting it to the status indicated in the top right column.		V2.80

CONFigure:MODulation:PERRor:GMSK:EREPorting *<Mode>*				Event Reporting
<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
SRQ |	Service request	OFF	–	–
SOPC |	Single operation complete			
SRSQ |	SRQ and SOPC			
OFF	No reporting			
Description of command				FW vers.
This command defines the events generated when the measurement is terminated or stopped (event reporting, see chapter 5 of CMU200 manual).				V2.80

FETCh:MODulation:PERRor:GMSK:STATus?				Measurement Status
Return	Description of parameters	Def. value	Def. unit	Unit ring
OFF |	Measurement in the *OFF* state (`*RST` or `ABORt`)	OFF	–	–
RUN |	Running (after `INITiate`, `CONTinue` or `READ`)			
STOP |	Stopped (`STOP`)			
ERR |	*OFF* (could not be started)			
STEP |	Stepping mode *(<stepmode>=STEP)*			
RDY,	Stopped according to repetition mode and stop condition			
1 to 10000 |	Counter for current statistics cycle			
NONE,	No counting mode set	NONE	–	–
1 to 1000 |	Counter for current evaluation period within a cycle			
NONE	Statistic count set to off	NONE	–	–
Description of command				FW vers.
This command is always a query. It returns the status of the measurement (see chapters 3 and 5).				V2.80

Subsystem MODulation:PERRor:GMSK:CONTrol

The subsystem *MODulation:PERRor:GMSK:CONTrol* defines the repetition mode, statistic count, and stop condition of the measurement. These settings are provided in the *Control* and *Statistics* tabs in the popup menu *Modulation Configuration*.

CONFigure:MODulation:PERRor:GMSK:CONTrol <*Mode*>, <*Statistics*>, <*Repetition*>, <*StopCond*>, <*Stepmode*> Scope of Measurement

<Mode>	Desciption of parameters	Def. value	Def. unit	Unit ring
SCALar | **ARRay,**	Scalar values only (incl. ramp matching) Scalar measured values and arrays	ARRay	–	–
<Statistics>	**Description of parameters**	**Def. value**	**Def. unit**	**Unit ring**
1 to 1000 | **NONE**	Number of bursts per statistics cycle Statistics off (equivalent to 1)	100	–	–
<Repetition>	**Description of parameters**	**Def. value**	**Def. unit**	**Unit ring**
CONTinuous | **SINGleshot |** **1 to 10000,**	Continuous measurement (until `STOP` or `ABORT`) Single shot measurement (until `Status = RDY`) Multiple measurement (*counting*, until `Status = STEP | RDY`)	SING	–	–
<StopCond>	**Description of parameters**	**Def. value**	**Def. unit**	**Unit ring**
SOERror | **NONE,**	Stop measurement in case of error *(stop on error)* Continue measurement even in case of error	NONE	–	–
<Stepmode>	**Description of parameters**	**Def. value**	**Def. unit**	**Unit ring**
STEP | **NONE**	Interrupt measurement after each statistics cycle Continue measurement according to its rep. mode	NONE	–	–

Description of command	FW-Vers.
This command defines the scope of the modulation measurement, combining the `...CONTrol:RMODe`, `...CONTrol:STATistics`, and the `...CONTrol:REPetition` commands (see below).	V2.80

CONFigure:MODulation:PERRor:GMSK:CONTrol:RMODe <*Mode*> Result Mode

<Mode>	Desciption of parameters	Def. value	Def. unit	Unit ring
SCALar | **ARRay,**	Scalar values only (incl. ramp matching) Scalar measured values and arrays	ARRay	–	–

Description of command	FW-Vers.
This command specifies the type of measured values.	V2.80

CONFigure:MODulation:PERRor:GMSK:CONTrol:STATistics <*Statistics*> Statistics Count

<Statistics>	Description of parameters	Def. value	Def. unit	Unit ring
1 to 1000 | **NONE**	Number of bursts per statistics cycle Statistics off (equivalent to 1)	100	–	–

Description of command	FW-Vers.
This command defines the number of bursts forming a statistics cycle.	V2.80

CONFigure:MODulation:PERRor:GMSK:CONTrol:REPetition *<Repetition> ,<StopCond>,<Stepmode>* Test cycles

<Repetition>	Description of parameters	Def. value	Def. unit	Unit ring
CONTinuous | **SINGleshot |** **1 to 10000,**	Continuous measurement (until `STOP` or `ABORT`) Single shot measurement (until `Status = RDY`) Multiple measurement (*counting*, until `Status = STEP ¦ RDY`)	SING	–	–
<StopCond>	Description of parameters	Def. value	Def. unit	Unit ring
SOERror | **NONE,**	Stop measurement in case of error *(stop on error)* Continue measurement even in case of error	NONE	–	–
<Stepmode>	Description of parameters	Def. value	Def. unit	Unit ring
STEP | **NONE**	Interrupt measurement after each statistics cycle Continue measurement according to its rep. mode	NONE	–	–

Description of command	FW vers.
This command determines the number of statistics cycles, the stop condition and the stepping mode for the measurement. **Note:** *In the case of READ commands (`READ:...`), the <Repetition> parameter has no effect; the measurement is always stopped after a single shot.*	V2.80

DEFault:MODulation:PERRor:GMSK:CONTrol ***<Enable>*** Default Settings

<Enable>	Description of parameters	Def. value	Def. unit	Unit ring
ON | **OFF**	All parameters are set to their default values Some or all parameters differ from the default values	ON	–	–

Description of command	FW vers.
If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to their default values (the setting *OFF* has no effect). If used as a query the command returns whether all parameters are set to their default values *(ON)* or not *(OFF)*.	V2.80

Tolerance values – Subsystem MODulation...:LIMit

The subsystem *MODulation...:LIMit* defines tolerance values for the modulation measurement. The subsystem corresponds to the tab *Limits* in the popup menu *Modulation*.

CONFigure:MODulation:PERRor:GMSK:CMMax:LIMit[:SCALar]:SYMMetric[:COMBined]:VALue **<PhaseErrorPeak>,<PhaseErrorRMS>,<FrequencyError>**
Limits for Current and Min./Max. Trace

Parameter	Description of parameters	Def. value	Def. unit	Unit ring
0.0 deg to +50.0 deg,	PhaseErrorPeak	+20.0	deg	Angle
0.0 deg to +50.0 deg,	PhaseErrorRMS	+5.0	deg	
0.0 Hz to +1000 Hz	FrequencyError	+45	Hz	

Description of command	FW vers.
This command defines upper limits for the peak and RMS phase error as well as for the frequency error in the *Current* and in the *Min./Max.* trace. The default frequency error is 23 Hz for GSM 400, 45 Hz for GSM900, 90 Hz for GSM1800/1900. The measurement is out of tolerance if the measured RMS phase error, the absolute value of the peak phase error, or the absolute value of the frequency error exceeds the specified limits.	V2.80

CONFigure:MODulation:PERRor:GMSK:AVERage:LIMit[:SCALar]:SYMMetric
[:COMBined]:VALue Limits for Average Trace
<PhaseErrorPeak>,<PhaseErrorRMS>,<FrequencyError>

Parameter	Description of parameters	Def. value	Def. unit	Unit ring
0.0 deg to +50.0 deg,	PhaseErrorPeak	+20.0	deg	Angle
0.0 deg to +50.0 deg,	PhaseErrorRMS	+5.0	deg	
0.0 Hz to +1000 Hz	FrequencyError	+45	Hz	

Description of command	FW vers.
This command defines upper limits for the peak and RMS phase error as well as for the frequency error in the *Average* trace. The default frequency error is 23 Hz for GSM 400, 45 Hz for GSM900, 90 Hz for GSM1800/1900. The measurement is out of tolerance if the measured RMS phase error, the absolute value of the peak phase error, or the absolute value of the frequency error exceeds the specified limits.	V2.80

DEFault:MODulation:PERRor:GMSK:LIMit <Enable> Default Settings

<Enable>	Description of parameters	Def. value	Def. unit	Unit ring
ON |	All parameters are set to their default values	ON	–	–
OFF	Some or all parameters differ from the default values			

Description of command	FW vers.
If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to their default values (the setting *OFF* has no effect). If used as a query the command returns whether all parameters are set to their default values *(ON)* or not *(OFF)*.	V2.80

Subsystem MODulation...:TIME

The subsystem *MODulation...:TIME* defines the decoding for the *Modulation* measurement. The subsystem corresponds to the popup window *Decode* in the graphical measurement menu *Modulation*.

CONFigure:MODulation:PERRor:GMSK:TIME:DECode <*Mode*> Decode

<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
STANdard |	The standard bit range is decoded	STANdard	–	–
GTBits	The guard and tail bits are also decoded			

Description of command	Sig. State	FW vers.
This command selects the type of decoding applied for the determination of phase and frequency errors.	all	V2.80

Subsystem SUBarrays:MODulation

The subsystem *SUBarrays:MODulation* defines the measurement range and the type of output values.

CONFigure:SUBarrays:MODulation:PERRor:GMSK
<Mode>,<Start>,<Samples>{,<Start>,<Samples>} Definition of Subarrays

<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
ALL | **ARIThmetical |** **MINimum |** **MAXimum,**	Return all measurement values Return arithm. mean value in every range Return minimum value in every range Return maximum value in every range	ALL	–	
<Start>	**Description of parameters**	**Def. value**	**Def. unit**	**Unit ring**
0 bit to 146 ¾ bit,	Start time in current range	0	bit	
<Samples>	**Description of parameters**	**Def. value**	**Def. unit**	**Unit ring**
0 to 588	Number of samples in current range	588	–	

Description of command	FW vers.
This command configures the `READ:SUBarrays...`, `FETCh:SUBarrays...`, and `SAMPle:SUBarrays:MODulation` commands. It restricts the measurement to up to 32 subranges where either all measurement results (the number of which is given by the second numerical parameter) or a single statistical value is returned. The subranges are defined by the start time and the number of test points which are located on a fixed, equidistant grid with a step width of ¼ bit. The subranges may overlap but must be within the total range of the *MODulation* measurement. Test points outside this range are not measured (result *NAN)* and do not enter into the ARIThmetical, MINimum and MAXimum values. By default, only one range corresponding to the total measurement range is used and all measurement values are returned.	V2.80

Measured Values – Subsystem MODulation:PERRor:GMSK

The subsystem *MODulation:PERRor:GMSK* measures and returns the frequency and phase errors and compares it with the tolerance values. The subsystem corresponds to the various output elements in the graphical measurement menu *MODulation*.

READ[:SCALar]:MODulation:PERRor:GMSK Scalar results:
Start single shot measurement and return results
FETCh[:SCALar]:MODulation:PERRor:GMSK?
Read out meas. results (unsynchronized)
SAMPle[:SCALar]:MODulation:PERRor:GMSK?
Read out measurement results (synchronized)

Return	Value range	Def. value	Def. unit	Unit ring
PhErrPeakCurrent,	–100.0 ° to +100.0 °	NAN	deg	
PhErrPeakAverage,	–100.0 ° to +100.0 °	NAN	deg	
PhErrPeakMaxMin,	–100.0 ° to +100.0 °	NAN	deg	
PhErrRMSCurrent,	–100.0 ° to +100.0 °	NAN	deg	
PhErrRMSAverage,	–100.0 ° to +100.0 °	NAN	deg	
PhErrRMSMaxMin,	–100.0 ° to +100.0 °	NAN	deg	
FreqErrCurrent,	–1000.0 Hz to + 1000.0 Hz	NAN	Hz	
FreqErrAverage,	–1000.0 Hz to + 1000.0 Hz	NAN	Hz	
FreqErrMaxMin	–1000.0 Hz to + 1000.0 Hz	NAN	Hz	
AvgBurstPowerCurr	–100.0 dBm to + 20.0 dBm	NAN	dBm	
AvgBurstPowerAvg	–100.0 dBm to + 20.0 dBm	NAN	dBm	
BurstsOutOfTol	0.0 % to 100.0 %	NAN	%	

Description of command	FW vers.
These commands are always queries. They start a measurement and output all scalar measurement results (see chapter 5). These are: Peak phase error of *Current* burst Peak phase error of *Average* trace Peak phase error of *Max./Min.* trace RMS phase error of *Current* burst RMS phase error of *Average* trace RMS phase error of *Max./Min.* trace Frequency error of *Current* burst Frequency error of *Average* trace Frequency error of *Max./Min.* trace Average burst power of current burst Average burst power of average burst Relative portion of faulty bursts The calculation of results in an *Average* or *Max./Min.* measurement is described in chapter 3 (cf. *calculation of statistical quantities*).	V2.80

CALCulate[:SCALar]:MODulation:PERRor:GMSK:MATChing:LIMit? Bursts out of Tolerance

Return	Value range	Def. value	Def. unit	Unit ring
PhErrPeakCurrent,		INV	–	–
PhErrPeakAverage,		INV	–	
PhErrPeakMaxMin,		INV	–	
PhErrRMSCurrent,	**For all measured values:**	INV	–	
PhErrRMSAverage,		INV	–	
PhErrRMSMaxMin,		INV	–	
FreqErrCurrent,	**NMAU |NMAL | INV | OK**	INV	–	
FreqErrAverage,		INV	–	
FreqErrMaxMin		INV	–	
AvgBurstPowerCurr		INV	–	
AvgBurstPowerAvg		INV	–	

Description of command	FW vers.
This command is always a query. It indicates whether and in which way the permissible error limits for the scalar measured values (see above command) have been exceeded. The following messages may be output for all measured values:	V2.80

NMAU	Underflow of tolerance value	*not matching, underflow*
NMAL	Tolerance value exceeded	*not matching, overflow*
INV	Measurement invalid	*invalid*
OK	all tolerances matched	

READ:ARRay:MODulation:PERRor:GMSK:CURRent? Phase Error in Burst
READ:ARRay:MODulation:PERRor:GMSK:AVERage?
READ:ARRay:MODulation:PERRor:GMSK:MMAXimum?
Start single shot measurement and return results *RUN*
FETCh:ARRay:MODulation:PERRor:GMSK:CURRent?
FETCh:ARRay:MODulation:PERRor:GMSK:AVERage?
FETCh:ARRay:MODulation:PERRor:GMSK:MMAXimum?
Read measurement results (unsynchronized) *RUN*
SAMPle:ARRay:MODulation:PERRor:GMSK:CURRent?
SAMPle:ARRay:MODulation:PERRor:GMSK:AVERage?
SAMPle:ARRay:MODulation:PERRor:GMSK:MMAXimum?
Read measurement results (synchronized) *RUN*

Return	Description of parameters	Def. value	Def. unit	Unit ring
–100.0 deg to+ 100.0 deg,	Phase Error [1],	NAN	deg	
... ,	...	...	...	
–100.0 deg to+ 100.0 deg	Phase Error [588]	NAN	deg	

Description of command	FW vers.
These commands are always queries. They return the values for the phase error of the burst in a fixed ¼-bit pattern. The number of measured values is 588, corresponding to a time range of 0 bit to 146 ¾ bit. The calculation of *current, average, minimum* and *maximum* results is explained in chapter 3 (cf. *display mode*).	V2.80

READ:SUBarrays:MODulation:PERRor:GMSK:CURRent? Subarray Results
READ:SUBarrays:MODulation:PERRor:GMSK:AVERage?
READ:SUBarrays:MODulation:PERRor:GMSK:MMAXimum?
Start single shot measurement and return results *RUN*
FETCh:SUBarrays:MODulation:PERRor:GMSK:CURRent?
FETCh:SUBarrays:MODulation:PERRor:GMSK:AVERage?
FETCh:SUBarrays:MODulation:PERRor:GMSK:MMAXimum?
Read meas. results (unsynchronized) *RUN*
SAMPle:SUBarrays:MODulation:PERRor:GMSK:CURRent?
SAMPle:SUBarrays:MODulation:PERRor:GMSK:AVERage?
SAMPle:SUBarrays:MODulation:PERRor:GMSK:MMAXimum?
Read results (synchronized) *RUN*

Ret. values per subrange	Description of parameters	Def. value	Def. unit	Unit ring
–100.0 deg to + 20.0 deg	Phase Error [1],	NAN	deg	
...	...	...	...	
–100.0 deg to + 20.0 deg	Phase Error [n]	NAN	deg	

Description of command	FW vers.
These commands are always queries. They output the phase error versus time in a fixed ¼- bit pattern and in the subranges defined by means of the `CONFigure:SUBarrays:MODulation...` command. In the default setting of the configuration command the `READ:SUBarrays...`, `FETCh:SUBarrays...`, and `SAMPle:SUBarrays...` command group is equivalent to the `READ:ARRay...`, `FETCh:ARRay...`, and `SAMPle:ARRay...` command group described above. The `CONFigure:SUBarrays:MODulation` command defines a maximum of 32 subranges. If one of the statistical modes `(ARIThmetical, MINimum, MAXimum)` is set, only one value is returned per subrange. The calculation of *current, average, minimum,* and *maximum* results is explained in chapter 3 (cf. *display mode*).	V2.80

MODulation:OVERview

The subsystem *MODulation:OVERview:EPSK* measures general scalar modulation parameters in 8PSK modulation. The subsystem corresponds to the measurement menu *Modulation,* application *Overview 8PSK,* and the associated popup menu *Modulation Configuration.*

Important Note!

> *The keyword `:EPSK` in the remote control commands of this section denotes 8PSK modulation. The commands are available with option CMU-K41 only.*

Control of Measurement – Subsystem MODulation:OVERview:EPSK

The subsystem *MODulation:OVERview:EPSK* controls the modulation measurement. It corresponds to the softkey *Overview 8PSK* in the measurement menu *Modulation.*

INITiate:MODulation:OVERview:EPSK	Start new measurement	*RUN*
ABORt:MODulation:OVERview:EPSK	Abort running measurement and switch off	*OFF*
STOP:MODulation:OVERview:EPSK	Stop measurement after current stat. cycle	*STOP*
CONTinue:MODulation:OVERview:EPSK	Next measurement step (only *stepping mode*)	*RUN*
Description of command		FW vers.
These commands have no query form. They start and stop the modulation measurement, setting it to the status indicated in the top right column.		V2.80

CONFigure:MODulation:OVERview:EPSK:EREPorting *<Mode>*				Event Reporting
<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
SRQ | **SOPC |** **SRSQ |** **OFF**	Service request Single operation complete SRQ and SOPC No reporting	OFF	–	–
Description of command				FW vers.
This command defines the events generated when the measurement is terminated or stopped *(event reporting,* see chapter 5 of CMU200 manual).				V2.80

FETCh:MODulation:OVERview:EPSK:STATus? Measurement Status

Ret. values	Description of parameters	Def. value	Def. unit	Unit ring
OFF | **RUN |** **STOP |** **ERR |** **STEP |** **RDY,**	Measurement in the *OFF* state (`*RST` or `ABORt`) Running (after `INITiate, CONTinue` or `READ`) Stopped (`STOP`) *OFF* (could not be started) Stepping mode *(<stepmode>=STEP)* Stopped according to repetition mode and stop condition	OFF	–	
1 to 10000 | **NONE,**	Counter for current statistics cycle No counting mode set	NONE	–	
1 to 1000 | **NONE**	Counter for current evaluation period within a cycle Statistic count set to off	NONE	–	
Description of command				FW vers.
This command is always a query. It returns the status of the measurement (see chapters 3 and 5).				V2.80

Test Configuration

The commands of the following subsystems configure the *Modulation* measurement. They correspond to the sections in the *Modulation Configuration* menu that are related to the *Overview* application.

Subsystem MODulation:OVERview:EPSK:CONTrol

The subsystem *MODulation:OVERview:EPSK:CONTrol* configures the modulation measurement. It corresponds to the tabs *Control* and *Statistics* in the popup menu *Modulation Configuration.*

CONFigure:MODulation:OVERview:EPSK:CONTrol *<Mode>, <Statistics>, <Repetition>, <StopCond>, <Stepmode>* Scope of Measurement

<Mode>	Desciption of parameters	Def. value	Def. unit	Unit ring
SCALar | **ARRay,**	Scalar values only (incl. ramp matching) Scalar measured values and arrays	ARRay	–	–
<Statistics>	Description of parameters	Def. value	Def. unit	Unit ring
1 to 1000 | **NONE**	Number of bursts per statistics cycle Statistics off (equivalent to 1)	200	–	–
<Repetition>	Description of parameters	Def. value	Def. unit	Unit ring
CONTinuous | **SINGleshot |** **1 to 10000,**	Continuous measurement (until `STOP` or `ABORT`) Single shot measurement (until `Status = RDY`) Multiple measurement (*counting*, until `Status = STEP | RDY`)	SING	–	–
<StopCond>	Description of parameters	Def. value	Def. unit	Unit ring
SOERror | **NONE,**	Stop measurement in case of error *(stop on error)* Continue measurement even in case of error	NONE	–	–

<Stepmode>	Description of parameters	Def. value	Def. unit	Unit ring
STEP | **NONE**	Interrupt measurement after each statistics cycle Continue measurement according to its rep. mode	NONE	–	–

Description of command	FW-Vers.
This command defines the scope of the modulation measurement, combining the `...CONTrol:RMODe`, `...CONTrol:STATistics`, and the `...CONTrol: REPetition` commands (see below).	1.0

CONFigure:MODulation:OVERview:EPSK:CONTrol:RMODe *<Mode>* Result Mode

<Mode>	Desciption of parameters	Def. value	Def. unit	Unit ring
SCALar | **ARRay,**	Scalar values only (incl. ramp matching) Scalar measured values and arrays	ARRay	–	–

Description of command	FW-Vers.
This command specifies the type of measured values.	1.0

CONFigure:MODulation:OVERview:EPSK:CONTrol:STATistics *<Statistics>* Statistics Count

<Statistics>	Description of parameters	Def. value	Def. unit	Unit ring
1 to 1000 | **NONE**	Number of bursts per statistics cycle Statistics off (equivalent to 1)	100	–	–

Description of command	FW-Vers.
This command defines the number of bursts forming a statistics cycle.	1.0

CONFigure:MODulation:OVERview:EPSK:CONTrol:REPetition
<Repetition>* ,*<StopCond>*,*<Stepmode> Test Cycles

<Repetition>	Description of parameters	Def. value	Def. unit	Unit ring
CONTinuous | **SINGleshot |** **1 to 10000**	Continuous measurement (until `STOP` or `ABORT`) Single shot measurement (until `Status = RDY`) Multiple measurement (*counting*, until `Status = STEP | RDY`)	SING	–	
<StopCond>	Description of parameters	Def. value	Def. unit	Unit ring
SOERror | **NONE**	Stop measurement in case of error *(stop on error)* Continue measurement even in case of error	NONE	–	
<Stepmode>	Description of parameters	Def. value	Def. unit	Unit ring
STEP | **NONE**	Interrupt measurement after each statistics cycle Continue measurement according to its rep. mode	NONE	–	

Description of command	FW vers.
This command determines the number of statistics cycles, the stop condition and the stepping mode for the measurement. **Note:** *In the case of READ commands (`READ:...`), the <Repetition> parameter has no effect; the measurement is always stopped after a single shot.*	V2.80

DEFault:MODulation:OVERview:EPSK:CONTrol ***<Mode>*** Default Settings

<Enable>	Description of parameters	Def. value	Def. unit	Unit ring
ON | **OFF**	The parameters are set to their default values Some or all parameters differ from the default values	ON	–	

Description of command	FW vers.
If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to their default values (the setting *OFF* has no effect). If used as a query the command returns whether all parameters are set to their default values *(ON)* or not *(OFF)*.	V2.80

Tolerance values – Subsystem MODulation:OEMP:EPSK:LIMit

The subsystem *MODulation:OEMP:EPSK:LIMit* defines tolerance values for the modulation measurement **in all four 8PSK applications**. The subsystem corresponds to the *Limits* tab in the popup menu *Modulation Configuration.*

CONFigure:MODulation:OEMP:EPSK:CMMax:LIMit[:SCALar]:SYMMetric[:COMBined]:VALue
CONFigure:MODulation:OEMP:EPSK:AVERage:LIMit[:SCALar]:SYMMetric[:COMBined]:VALue
<EVMErrorPeak>,<EVMErrorRMS>,<MagnErrorPeak>, <MagnErrorRMS>, <PhaseErrorPeak>, <PhaseErrorRMS>, <OriginOffset>, <IQImbalance>, <FreqError> Limits Current & Max

Parameter	Description of parameters	Def. value	Def. unit	Unit ring
0.0 % to +50.0 %,	EVM Error Peak	+22.0	%	
0.0 % to +50.0 %,	EVM Error RMS	+8.0	%	
0.0 % to +50.0 %,	Magn Error Peak	+22.0	%	
0.0 % to +50.0 %,	Magn Error RMS	+8.0	%	
0.0 deg to +50.0 deg,	Phase Error Peak	+180.0	deg	
0.0 deg to +50.0 deg,	Phase Error RMS	+180.0	deg	
–100.0 dB to 0.0 dB,	Origin Offset	–35.0	dB	
–100.0 dB to 0.0 dB,	IQ Imbalance	–20.0	dB	
0 Hz to 999 Hz	Frequency Error	+45	Hz	

Description of command	FW vers.
These commands define upper limits for the *Current* and *Max./Min.* traces (keyword `CMMax`) as well as for the *Average* trace (keyword `AVERage`) and for the scalar modulation parameters derived from them. The default value for the frequency error depends on the GSM band: It is 23 Hz for GSM 400, 45 Hz for GSM 900, and 90 Hz for GSM 1800 and GSM 1900.	V2.80

CONFigure:MODulation:OEMP:EPSK:P95Th:LIMit[:SCALar]:SYMMetric[:COMBined]:VALue *<EVM95%>, <MError95%>, <PError95%>*

95th Percentile

Parameter	Description of parameters	Def. value	Def. unit	Unit ring
0% to 50.0%,	95th percentile EVM	+11.0	%	
0% to 50.0%,	95th percentile magnitude error	+11.0	%	
0° to 180°	95th percentile phase error	+11.0	deg	

Description of command	FW vers.
This command defines upper limits for the 95th percentile of the three quantities *error vector magnitude*, *magnitude error*, and *phase error*. The 95th percentile is the limit below which 95% of the measured errors are located.	V2.80

DEFault:MODulation:OEMP:EPSK:LIMit *<Mode>*

Default Settings

<Enable>	Description of parameters	Def. value	Def. unit	Unit ring
ON |	The parameters are set to their default values	ON	–	
OFF	Some or all parameters differ from the default values			

Description of command	FW vers.
If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to their default values (the setting *OFF* has no effect). If used as a query the command returns whether all parameters are set to their default values *(ON)* or not *(OFF)*.	V2.80

Measured Values – Subsystem MODulation:OVERview:EPSK

The subsystem *MODulation:OVERview:EPSK* measures and returns the modulation parameters and compares them with the tolerance values. The subsystem corresponds to the various output elements in the *Modulation* measurement menu, application *Overview 8PSK*.

READ[:SCALar]:MODulation:OVERview:EPSK?

Scalar Results:
Start single shot measurement and return results

FETCh[:SCALar]:MODulation:OVERview:EPSK?

Read out meas. results (unsynchronized)

SAMPle[:SCALar]:MODulation:OVERview:EPSK?

Read out measurement results (synchronized)

Returned values	Value range	Def. value	Def. unit	Unit ring
95thPercentileEVM,	0.0 % to 100.0 %	NAN	%	
95thPercentileMagErr,	0.0 % to 100.0 %	NAN	%	
95thPercentilePhErr,	–100.0 deg to +100.0 deg	NAN	deg	
EVMPeak (x3),	0.0 % to 100.0 %	NAN	%	
EVMRMS (x3),	0.0 % to 100.0 %	NAN	%	
MagnErrorPeak (x3),	0.0 % to 100.0 %	NAN	%	
MagnErrorRMS (x3),	0.0 % to 100.0 %	NAN	%	
PhErrorPeak(x3),	–100.0 deg to +100.0 deg	NAN	deg	
PhErrorRMS (x3),	–100.0 deg to +100.0 deg	NAN	deg	
OriginOffset (x3),	–100.0 dB to +100.0 dB	NAN	dB	
IQImbalance (x3),	–100.0 dB to +100.0 dB	NAN	dB	
FrequencyError (x3),	–1000.0 Hz to +1000.0 Hz	NAN	Hz	
AvgBurstPowerCurr,	–100.0 dBm to +20.0 dBm	NAN	dBm	
BurstsOutOfTol	0.0 % to 100.0 %	NAN	%	

Description of command	FW vers.
These commands are always queries. They start a modulation measurement and output all scalar measurement results (see chapter 4). The calculation of results in an *average* or *peak* measurement is described in chapter 3 (see *calculation of statistical quantities*). The symbol (x3) behind a value indicates that the list contains three results corresponding to the *Current*, the *Average*, and the *MMax* value.	V2.80

CALCulate[:SCALar]:MODulation:OVERview:EPSK:MATChing:LIMit? Bursts out of Tolerance

Returned values	Value range	Def. value	Def. unit	Unit ring
95thPercentileEVM,		INV	–	
95thPercentileMagErr,		INV	–	
95thPercentilePhErr,		INV	–	
EVMPeak (x3),	**For all measured values:**	INV	–	
EVMRMS (x3),		INV	–	
MagnErrorPeak (x3),		INV	–	
MagnErrorRMS (x3),		INV	–	
PhErrorPeak(x3),	**NMAU |NMAL | INV | OK**	INV	–	
PhErrorRMS (x3),		INV	–	
OriginOffset (x3),		INV	–	
IQImbalance (x3),		INV	–	
FrequencyError (x3),		INV	–	
AvgBurstPowerCurr		INV	–	

Description of command	FW vers.
This command is always a query. It indicates whether and in which way the error limits for the scalar measured values (see above command) have been exceeded. The symbol (x3) behind a value indicates that the list contains three results corresponding to the *Current*, the *Average*, and the *MMax* value.	V2.80

The following messages may be output for all measured values:

NMAU	Underflow of tolerance value	*not matching, underflow*
NMAL	Tolerance value exceeded	*not matching, overflow*
INV	Measurement invalid	*invalid*
OK	all tolerances matched	

MODulation:EVMagnitude

The subsystem *MODulation:EVMagnitude* measures the error vector magnitude as well as general scalar modulation parameters. The subsystem corresponds to the measurement menu *Modulation,* application *Error Vect. Magn. 8PSK,* and the associated popup menu *Modulation Configuration.*

Important Note!

> *The keyword `:EPSK` in the remote control commands of this section denotes 8PSK modulation. The commands are available with option CMU-K41 only.*

Control of Measurement – Subsystem MODulation:EVMagnitude

The subsystem *MODulation:EVMagnitude* controls the modulation measurement. It corresponds to the softkey *EVM 8PSK* in the measurement menu *Modulation.*

INITiate:MODulation:EVMagnitude:EPSK	Start new measurement	*RUN*
ABORt:MODulation:EVMagnitude:EPSK	Abort running measurement and switch off	*OFF*
STOP:MODulation:EVMagnitude:EPSK	Stop measurement after current stat. cycle	*STOP*
CONTinue:MODulation:EVMagnitude:EPSK	Next meas. step (only *stepping mode*)	*RUN*

Description of command	FW vers.
These commands have no query form. They start and stop the modulation measurement, setting it to the status indicated in the top right column.	V2.80

CONFigure:MODulation:EVMagnitude:EPSK:EREPorting *<Mode>* Event Reporting

<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
SRQ |	Service request	OFF	–	
SOPC |	Single operation complete			
SRSQ |	SRQ and SOPC			
OFF	No reporting			

Description of command	FW vers.
This command defines the events generated when the measurement is terminated or stopped *(event reporting,* see chapter 5 of CMU200 manual).	V2.80

FETCh:MODulation:EVMagnitude:EPSK:STATus? Measurement Status

Ret. values	Description of parameters	Def. value	Def. unit	Unit ring
OFF | **RUN |** **STOP |** **ERR |** **STEP |** **RDY,**	Measurement in the *OFF* state (`*RST` or `ABORt`) Running (after `INITiate, CONTinue` or `READ`) Stopped (`STOP`) *OFF* (could not be started) Stepping mode *(<stepmode>=STEP)* Stopped according to repetition mode and stop condition	OFF	–	
1 to 10000 | **NONE,**	Counter for current statistics cycle No counting mode set	NONE	–	
1 to 1000 | **NONE**	Counter for current evaluation period within a cycle Statistic count set to off	NONE	–	

Description of command	FW vers.
This command is always a query. It returns the status of the measurement (see chapters 3 and 5).	V2.80

Test Configuration

The commands of the following subsystems configure the *Modulation* measurement. They correspond to the sections in the *Modulation Configuration* menu that are related to the *Error Vector Magnitude* application.

Subsystem MODulation:EVMagnitude:EPSK:CONTrol

The subsystem *MODulation:EVMagnitude:EPSK:CONTrol* configures the modulation measurement. It corresponds to the tabs *Control* and *Statistics* in the popup menu *Modulation Configuration*.

CONFigure:MODulation:EVMagnitude:EPSK:CONTrol *<Mode>, <Statistics>, <Repetition>, <StopCond>, <Stepmode>* Scope of Measurement

<Mode>	Desciption of parameters	Def. value	Def. unit	Unit ring
SCALar | **ARRay,**	Scalar values only (incl. ramp matching) Scalar measured values and arrays	ARRay	–	–
<Statistics>	Description of parameters	Def. value	Def. unit	Unit ring
1 to 1000 | **NONE**	Number of bursts per statistics cycle Statistics off (equivalent to 1)	100	–	–
<Repetition>	Description of parameters	Def. value	Def. unit	Unit ring
CONTinuous | **SINGleshot |** **1 to 10000,**	Continuous measurement (until `STOP` or `ABORT`) Single shot measurement (until `Status = RDY`) Multiple measurement (*counting*, until `Status = STEP | RDY`)	SING	–	–
<StopCond>	Description of parameters	Def. value	Def. unit	Unit ring
SOERror | **NONE,**	Stop measurement in case of error *(stop on error)* Continue measurement even in case of error	NONE	–	–

<Stepmode>	Description of parameters	Def. value	Def. unit	Unit ring
STEP | **NONE**	Interrupt measurement after each statistics cycle Continue measurement according to its rep. mode	NONE	–	–

Description of command	FW-Vers.
This command defines the scope of the modulation measurement, combining the `...CONTrol:RMODe`, `...CONTrol:STATistics`, and the `...CONTrol: REPetition` commands (see below).	1.0

CONFigure:MODulation:EVMagnitude:EPSK:CONTrol:RMODe *<Mode>* Result Mode

<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
SCALar | **ARRay,**	Scalar values only (incl. ramp matching) Scalar measured values and arrays	ARRay	–	–

Description of command	FW-Vers.
This command specifies the type of measured values.	1.0

CONFigure:MODulation:EVMagnitude:EPSK:CONTrol:STATistics *<Statistics>* Statistics Count

<Statistics>	Description of parameters	Def. value	Def. unit	Unit ring
1 to 1000 | **NONE**	Number of bursts per statistics cycle Statistics off (equivalent to 1)	100	–	–

Description of command	FW-Vers.
This command defines the number of bursts forming a statistics cycle.	1.0

CONFigure:MODulation:EVMagnitude:EPSK:CONTrol:REPetition
<Repetition> ,<StopCond>,<Stepmode> Test Cycles

<Repetition>	Description of parameters	Def. value	Def. unit	Unit ring
CONTinuous | **SINGleshot |** **1 to 10000**	Continuous measurement (until `STOP` or `ABORT`) Single shot measurement (until `Status = RDY`) Multiple measurement (*counting*, until `Status = STEP | RDY`)	SING	–	
<StopCond>	**Description of parameters**	**Def. value**	**Def. unit**	**Unit ring**
SOERror | **NONE**	Stop measurement in case of error *(stop on error)* Continue measurement even in case of error	NONE	–	
<Stepmode>	**Description of parameters**	**Def. value**	**Def. unit**	**Unit ring**
STEP | **NONE**	Interrupt measurement after each statistics cycle Continue measurement according to its rep. mode	NONE	–	

Description of command	FW vers.
This command determines the number of statistics cycles, the stop condition and the stepping mode for the measurement. **Note:** *In the case of READ commands (`READ:...`), the <Repetition> parameter has no effect; the measurement is always stopped after a single shot.*	V2.80

DEFault:MODulation:EVMagnitude:EPSK:CONTrol <*Mode*>				Default Settings
<Enable>	Description of parameters	Def. value	Def. unit	Unit ring
ON | **OFF**	The parameters are set to their default values Some or all parameters differ from the default values	ON	–	
Description of command				FW vers.
If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to their default values (the setting *OFF* has no effect). If used as a query the command returns whether all parameters are set to their default values *(ON)* or not *(OFF)*.				V2.80

Tolerance values – Subsystem MODulation:OEMP:EPSK:LIMit

The subsystem *MODulation:OEMP:EPSK:LIMit* (see p. 6.35 ff) defines tolerance values for the modulation measurement **in all four EPSK applications**. The subsystem corresponds to the *Limits* tab in the popup menu *Modulation Configuration.*

Subsystem SUBarrays:MODulation

The subsystem *SUBarrays:MODulation* defines the measurement range and the type of output values.

CONFigure:SUBarrays:MODulation:EVMagnitude:EPSK <Mode>,<Start>,<Samples>{,<Start>,<Samples>}				Definition of Subarrays
<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
ALL | **ARIThmetical |** **MINimum |** **MAXimum,**	Return all measurement values Return arithm. mean value in every range Return minimum value in every range Return maximum value in every range	ALL	–	
<Start>	Description of parameters	Def. value	Def. unit	Unit ring
3 symb to 144 symb,	Start time in current range	0	symb	
<Samples>	Description of parameters	Def. value	Def. unit	Unit ring
0 to 142	Number of samples in current range	142	–	
Description of command				FW vers.
This command configures the `READ:SUBarrays...`, `FETCh:SUBarrays...`, and `SAMPle:SUBarrays:MODulation:EVMagnitude:EPSK` commands. It restricts the measurement to up to 32 subranges where either all measurement results (the number of which is given by the second numerical parameter) or a single statistical value is returned. The subranges are defined by the start time and the number of test points which are located on a fixed, equidistant grid with a step width of 1 symb. The subranges may overlap but must be within the total range of the *Modulation* measurement. Test points outside this range are not measured (result *NAN)* and do not enter into the ARIThmetical, MINimum and MAXimum values. By default, only one range corresponding to the total measurement range is used and all measurement values are returned.				V2.80

Measured Values – Subsystem MODulation:EVMagnitude:EPSK

The subsystem *MODulation:EVMagnitude:EPSK* measures and returns the modulation parameters and compares them with the tolerance values. The subsystem corresponds to the various output elements in the measurement menu *MODulation,* application *EVM 8PSK.*

READ[:SCALar]:MODulation:EVMagnitude:EPSK Scalar Results: Start single shot measurement and return results

FETCh[:SCALar]:MODulation:EVMagnitude:EPSK Read out meas. results (unsynchronized)

SAMPle[:SCALar]:MODulation:EVMagnitude:EPSK Read out measurement results (synchronized)

Returned values	Value range	Def. value	Def. unit	Unit ring
95thPercentileEVM	0.0 % to 100.0 %	NAN	%	
EVMPeak (x3),	0.0 % to 100.0 %	NAN	%	
EVMRMS (x3),	0.0 % to 100.0 %	NAN	%	
OriginOffset (x3),	–100.0 dB to +100.0 dB	NAN	dB	
IQImbalance (x3),	–100.0 dB to +100.0 dB	NAN	dB	
FrequencyError (x3),	–1000.0 Hz to +1000.0 Hz	NAN	Hz	
AvgBurstPowerCurr,	–100.0 dBm to +20.0 dBm	NAN	dBm	
AvgBurstPowerAvg	–100.0 dBm to +20.0 dBm	NAN	dBm	
BurstsOutOfTol	0.0 % to 100.0 %	NAN	%	

Description of command	FW vers.
These commands are always queries. They start a modulation measurement and output all scalar measurement results (see chapter 4). The calculation of results in an *average* or *peak* measurement is described in chapter 3 (see *calculation of statistical quantities*). The symbol (x3) behind a value indicates that the list contains three results corresponding to the *Current*, the *Average,* and the *MMax* value.	V2.80

CALCulate[:SCALar]:MODulation:EVMagnitude:EPSK:MATChing:LIMit? Bursts out of Tolerance

Returned values	Value range	Def. value	Def. unit	Unit ring
95thPercentileEVM	**For all measured values:**	INV	–	
PhErrorPeak (x3),		INV	–	
PhErrorRMS (x3),		INV	–	
		INV	–	
OriginOffset (x3),	**NMAU |NMAL | INV | OK**			
IQImbalance (x3),		INV	–	
FrequencyError(x3)		INV	–	

Description of command	FW vers.
This command is always a query. It indicates whether and in which way the error limits for the scalar measured values (see above command) have been exceeded. The symbol (x3) behind a value indicates that the list contains three results corresponding to the *Current*, the *Average*, and the *MMax* value. The limits are defined with the `CONFigure:MODulation:OEMP`... commands. The following messages may be output for all measured values:	V2.80

NMAU	Underflow of tolerance value	*not matching, underflow*
NMAL	Tolerance value exceeded	*not matching, overflow*
INV	Measurement invalid	*invalid*
OK	all tolerances matched	

READ:ARRay:MODulation:EVMagnitude:EPSK:CURRent? Phase Error in Burst
READ:ARRay:MODulation:EVMagnitude:EPSK:AVERage?
READ:ARRay:MODulation:EVMagnitude:EPSK:MMAXimum?
Start single shot measurement and return results *RUN*
FETCh:ARRay:MODulation:EVMagnitude:EPSK:CURRent?
FETCh:ARRay:MODulation:EVMagnitude:EPSK:AVERage?
FETCh:ARRay:MODulation:EVMagnitude:EPSK:MMAXimum?
Read measurement results (unsynchronized) *RUN*
SAMPle:ARRay:MODulation:EVMagnitude:EPSK:CURRent?
SAMPle:ARRay:MODulation:EVMagnitude:EPSK:AVERage?
SAMPle:ARRay:MODulation:EVMagnitude:EPSK:MMAXimum?
Read measurement results (synchronized) *RUN*

Returned values	Description of parameters	Def. value	Def. unit	Unit ring
0.0 % to+ 100.0 %,	1st value for error vector magnitude	NAN	%	
... ,	...	...	...	
0.0 % to+ 100.0 %	142th value for error vector magnitude	NAN	%	

Description of command	FW vers.
These commands are always queries. They return the error vector magnitude vs. time at fixed, equidistant test points. The number of measured values is 142, corresponding to a time range of 3 symb to 144 symb. The calculation of *Current, Average, and MMax* (Min./Max.) results is explained in chapter 3 (see *display mode*).	V2.80

READ:SUBarrays:MODulation:EVMagnitude:EPSK:CURRent? Subarray Results
READ:SUBarrays:MODulation:EVMagnitude:EPSK:AVERage?
READ:SUBarrays:MODulation:EVMagnitude:EPSK:MMAXimum?
Start single shot measurement and return results *RUN*
FETCh:SUBarrays:MODulation:EVMagnitude:EPSK:CURRent?
FETCh:SUBarrays:MODulation:EVMagnitude:EPSK:AVERage?
FETCh:SUBarrays:MODulation:EVMagnitude:EPSK:MMAXimum?
Read meas. results (unsynchronized) *RUN*
SAMPle:SUBarrays:MODulation:EVMagnitude:EPSK:CURRent?
SAMPle:SUBarrays:MODulation:EVMagnitude:EPSK:AVERage?
SAMPle:SUBarrays:MODulation:EVMagnitude:EPSK:MMAXimum?
Read results (synchronized) *RUN*

Ret. values per subrange	Description of parameters	Def. value	Def. unit	Unit ring
0.0 % to+ 100.0 %,	1st value for error vector magnitude	NAN	%	
... ,	...	...	...	
0.0 % to+ 100.0 %	nth value for error vector magnitude	NAN	%	

Description of command	FW vers.
These commands are always queries. They measure and return the error vector magnitude versus time in the subranges defined by means of the `CONFigure:SUBarrays:MODulation:EVMagnitude:EPSK` command. In the default setting of the configuration command the `READ:SUBarrays...`, `FETCh:SUBarrays...`, and `SAMPle:SUBarrays...` command group is equivalent to the `READ:ARRay...`, `FETCh:ARRay...`, and `SAMPle:ARRay...` command group described above. The `CONFigure:SUBarrays:MODulation:EVMagnitude:EPSK` command defines a maximum of 32 subranges. If one of the statistical modes `(ARIThmetical, MINimum, MAXimum)` is set, only one value is returned per subrange. The calculation of *current*, *average*, *minimum*, and *maximum* results is explained in chapter 3 (see *display mode*).	V2.80

MODulation:PERRor:EPSK

The subsystem *MODulation:PERRor* measures the phase error as well as general scalar modulation parameters. The subsystem corresponds to the measurement menu *Modulation,* application *Phase Error 8PSK,* and the associated popup menu *Modulation Configuration.*

Important Note!

The keyword `:EPSK` *in the remote control commands of this section denotes 8PSK modulation. The commands are available with option CMU-K41 only.*

Control of Measurement – Subsystem MODulation:PERRor

The subsystem *MODulation:PERRor* controls the modulation measurement. It corresponds to the softkey *Phase Error 8PSK* in the measurement menu *Modulation*.

INITiate:MODulation:PERRor:EPSK	Start new measurement	*RUN*
ABORt:MODulation:PERRor:EPSK	Abort running measurement and switch off	*OFF*
STOP:MODulation:PERRor:EPSK	Stop measurement after current stat. cycle	*STOP*
CONTinue:MODulation:PERRor:EPSK	Next measurement step (only *stepping mode*)	*RUN*
Description of command		FW vers.
These commands have no query form. They start and stop the modulation measurement, setting it to the status indicated in the top right column.		V2.80

CONFigure:MODulation:PERRor:EPSK:EREPorting <*Mode*>				Event Reporting
<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
SRQ |	Service request	OFF	–	
SOPC |	Single operation complete			
SRSQ |	SRQ and SOPC			
OFF	No reporting			
Description of command				FW vers.
This command defines the events generated when the measurement is terminated or stopped *(event reporting,* see chapter 5 of CMU200 manual).				V2.80

FETCh:MODulation:PERRor:EPSK:STATus?				Measurement Status
Ret. values	Description of parameters	Def. value	Def. unit	Unit ring
OFF |	Measurement in the *OFF* state (`*RST` or `ABORt`)	OFF	–	
RUN |	Running (after `INITiate, CONTinue` or `READ`)			
STOP |	Stopped (`STOP`)			
ERR |	*OFF* (could not be started)			
STEP |	Stepping mode *(<stepmode>=STEP)*			
RDY,	Stopped according to repetition mode and stop condition			
1 to 10000 |	Counter for current statistics cycle			
NONE,	No counting mode set	NONE	–	
1 to 1000 |	Counter for current evaluation period within a cycle			
NONE	Statistic count set to off	NONE	–	
Description of command				FW vers.
This command is always a query. It returns the status of the measurement (see chapters 3 and 5).				V2.80

Test Configuration

The commands of the following subsystems configure the *Modulation* measurement. They correspond to the sections in the *Modulation Configuration* menu that are related to the *Magnitude Error* application.

Subsystem MODulation:PERRor:EPSK:CONTrol

The subsystem *MODulation:PERRor:EPSK:CONTrol* configures the modulation measurement. It corresponds to the tabs *Control* and *Statistics* in the popup menu *Modulation Configuration*.

CONFigure:MODulation:PERRor:EPSK:CONTrol *<Mode>*, *<Statistics>*, *<Repetition>*, *<StopCond>*, *<Stepmode>*				Scope of Measurement
<Mode>	Desciption of parameters	Def. value	Def. unit	Unit ring
SCALar |	Scalar values only (incl. ramp matching)	ARRay	–	–
ARRay,	Scalar measured values and arrays			
<Statistics>	Description of parameters	Def. value	Def. unit	Unit ring
1 to 1000 |	Number of bursts per statistics cycle	100	–	–
NONE	Statistics off (equivalent to 1)			
<Repetition>	Description of parameters	Def. value	Def. unit	Unit ring
CONTinuous |	Continuous measurement (until `STOP` or `ABORT`)	SING	–	–
SINGleshot |	Single shot measurement (until `Status = RDY`)			
1 to 10000,	Multiple measurement (*counting*, until `Status = STEP | RDY`)			
<StopCond>	Description of parameters	Def. value	Def. unit	Unit ring
SOERror |	Stop measurement in case of error *(stop on error)*	NONE	–	–
NONE,	Continue measurement even in case of error			

<Stepmode>	Description of parameters	Def. value	Def. unit	Unit ring
STEP | **NONE**	Interrupt measurement after each statistics cycle Continue measurement according to its rep. mode	NONE	–	–

Description of command	FW-Vers.
This command defines the scope of the modulation measurement, combining the `...CONTrol:RMODe`, `...CONTrol:STATistics`, and the `...CONTrol: REPetition` commands (see below).	1.0

CONFigure:MODulation:PERRor:EPSK:CONTrol:RMODe *<Mode>* Result Mode

<Mode>	Desciption of parameters	Def. value	Def. unit	Unit ring
SCALar | **ARRay,**	Scalar values only (incl. ramp matching) Scalar measured values and arrays	ARRay	–	–

Description of command	FW-Vers.
This command specifies the type of measured values.	1.0

CONFigure:MODulation:PERRor:EPSK:CONTrol:STATistics *<Statistics>* Statistics Count

<Statistics>	Description of parameters	Def. value	Def. unit	Unit ring
1 to 1000 | **NONE**	Number of bursts per statistics cycle Statistics off (equivalent to 1)	100	–	–

Description of command	FW-Vers.
This command defines the number of bursts forming a statistics cycle.	1.0

CONFigure:MODulation:PERRor:EPSK:CONTrol:REPetition
<Repetition> ,<StopCond>,<Stepmode> Test Cycles

<Repetition>	Description of parameters	Def. value	Def. unit	Unit ring
CONTinuous | **SINGleshot |** **1 to 10000**	Continuous measurement (until `STOP` or `ABORT`) Single shot measurement (until `Status = RDY`) Multiple measurement (*counting*, until `Status = STEP | RDY`)	SING	–	
<StopCond>	Description of parameters	Def. value	Def. unit	Unit ring
SOERror | **NONE**	Stop measurement in case of error *(stop on error)* Continue measurement even in case of error	NONE	–	
<Stepmode>	Description of parameters	Def. value	Def. unit	Unit ring
STEP | **NONE**	Interrupt measurement after each statistics cycle Continue measurement according to its rep. mode	NONE	–	

Description of command	FW vers.
This command determines the number of statistics cycles, the stop condition and the stepping mode for the measurement. **Note:** *In the case of READ commands (`READ:...`), the <Repetition> parameter has no effect; the measurement is always stopped after a single shot.*	V2.80

DEFault:MODulation:PERRor:EPSK:CONTrol <*Mode*>				Default Settings
<Enable>	Description of parameters	Def. value	Def. unit	Unit ring
ON | **OFF**	The parameters are set to their default values Some or all parameters differ from the default values	ON	–	
Description of command				FW vers.
If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to their default values (the setting *OFF* has no effect). If used as a query the command returns whether all parameters are set to their default values *(ON)* or not *(OFF)*.				V2.80

Tolerance values – Subsystem MODulation:OEMP:EPSK:LIMit

The subsystem *MODulation:OEMP:EPSK:LIMit* (see p. 6.35 ff) defines tolerance values for the modulation measurement **in all four EPSK applications**. The subsystem corresponds to the *Limits* tab in the popup menu *Modulation Configuration.*

Subsystem SUBarrays:MODulation:PERRor:EPSK

The subsystem *SUBarrays:MODulation* defines the measurement range and the type of output values.

CONFigure:SUBarrays:MODulation:PERRor:EPSK **<Mode>,<Start>,<Samples>{,<Start>,<Samples>}**				Definition of Subarrays
<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
ALL | **ARIThmetical |** **MINimum |** **MAXimum,**	Return all measurement values Return arithm. mean value in every range Return minimum value in every range Return maximum value in every range	ALL	–	
<Start>	Description of parameters	Def. value	Def. unit	Unit ring
3 symb to 144 symb,	Start time in current range	0	symb	
<Samples>	Description of parameters	Def. value	Def. unit	Unit ring
0 to 142	Number of samples in current range	142	–	
Description of command				FW vers.
This command configures the `READ:SUBarrays...`, `FETCh:SUBarrays...`, and `SAMPle:SUBarrays:MODulation:PERRor:EPSK` commands. It restricts the measurement to up to 32 subranges where either all measurement results (the number of which is given by the second numerical parameter) or a single statistical value is returned. The subranges are defined by the start time and the number of test points which are located on a fixed, equidistant grid with a step width of 1 symb. The subranges may overlap but must be within the total range of the *Modulation* measurement. Test points outside this range are not measured (result *NAN)* and do not enter into the ARIThmetical, MINimum and MAXimum values. By default, only one range corresponding to the total measurement range is used and all measurement values are returned.				V2.80

Measured Values – Subsystem MODulation:PERRor:EPSK

The subsystem *MODulation:PERRor:EPSK* measures and returns the modulation parameters and compares them with the tolerance values. The subsystem corresponds to the various output elements in the measurement menu *MODulation,* application *Phase Error 8PSK.*

READ[:SCALar]:MODulation:PERRor:EPSK? Scalar Results:
Start single shot measurement and return results
FETCh[:SCALar]:MODulation:PERRor:EPSK?
Read out meas. results (unsynchronized)
SAMPle[:SCALar]:MODulation:PERRor:EPSK?
Read out measurement results (synchronized)

Returned values	Value range	Def. value	Def. unit	Unit ring
95thPercentilePhError	0.0 deg to 50.0 deg	NAN	deg	
EVMPeak (x3),	0.0 % to 100.0 %	NAN	%	
EVMRMS (x3),	0.0 % to 100.0 %	NAN	%	
OriginOffset (x3),	–100.0 dB to +100.0 dB	NAN	dB	
IQImbalance (x3),	–100.0 dB to +100.0 dB	NAN	dB	
FrequencyError (x3),	–1000.0 Hz to +1000.0 Hz	NAN	Hz	
AvgBurstPowerCurr,	–100.0 dBm to +20.0 dBm	NAN	dBm	
AvgBurstPowerAvg	–100.0 dBm to +20.0 dBm	NAN	dBm	
BurstsOutOfTol	0.0 % to 100.0 %	NAN	%	

Description of command	FW vers.
These commands are always queries. They start a modulation measurement and output all scalar measurement results (see chapter 4), either for the whole burst or for the 1st ten valid symbols in the burst. The calculation of results in an *average* or *peak* measurement is described in chapter 3 (see *calculation of statistical quantities*). The symbol (x3) behind a value indicates that the list contains three results corresponding to the *Current*, the *Average,* and the *MMax* value.	V2.80

CALCulate[:SCALar]:MODulation:PERRor:EPSK:MATChing:LIMit? Bursts out of Tolerance

Returned values	Value range	Def. value	Def. unit	Unit ring
95thPercentilePhError		INV	–	
PhErrorPeak (x3),		INV	–	
PhErrorRMS (x3),	**For all measured values:**	INV	–	
			–	
OriginOffset (x3),	**NMAU |NMAL | INV | OK**	INV		
IQImbalance (x3),		INV	–	
FrequencyError(x3)		INV	–	

Description of command	FW vers.
This command is always a query. It indicates whether and in which way the error limits for the scalar measured values (see above command) have been exceeded. The symbol (x3) behind a value indicates that the list contains three results corresponding to the *Current*, the *Average*, and the *MMax* value. The limits are defined with the `CONFigure:MODulation:OEMP...` commands. The following messages may be output for all measured values: NMAU Underflow of tolerance value *not matching, underflow* NMAL Tolerance value exceeded *not matching, overflow* INV Measurement invalid *invalid* OK all tolerances matched	V2.80

READ:ARRay:MODulation:PERRor:EPSK:CURRent? Phase Error in Burst
READ:ARRay:MODulation:PERRor:EPSK:AVERage?
READ:ARRay:MODulation:PERRor:EPSK:MMAXimum?
Start single shot measurement and return results *RUN*
FETCh:ARRay:MODulation:PERRor:EPSK:CURRent?
FETCh:ARRay:MODulation:PERRor:EPSK:AVERage?
FETCh:ARRay:MODulation:PERRor:EPSK:MMAXimum?
Read measurement results (unsynchronized) *RUN*
SAMPle:ARRay:MODulation:PERRor:EPSK:CURRent?
SAMPle:ARRay:MODulation:PERRor:EPSK:AVERage?
SAMPle:ARRay:MODulation:PERRor:EPSK:MMAXimum?
Read measurement results (synchronized) *RUN*

Returned values	Description of parameters	Def. value	Def. unit	Unit ring
–100.0 deg to+ 100.0 deg,	1st value for phase error	NAN	deg	
... ,	...	...	...	
–100.0 deg to+ 100.0 deg	142nd value for phase error	NAN	deg	

Description of command	FW vers.
These commands are always queries. They return the the phase error vs. time at fixed, equidistant test points. The number of measured values is 142, corresponding to a time range of 3 symb to 144 symb. The calculation of *CURRent, AVERage, and MMAX* (Min./Max.) results is explained in chapter 3 (see *display mode*).	V2.80

READ:SUBarrays:MODulation:PERRor:EPSK:CURRent? Subarray Results
READ:SUBarrays:MODulation:PERRor:EPSK:AVERage?
READ:SUBarrays:MODulation:PERRor:EPSK:MMAXimum?
Start single shot measurement and return results *RUN*
FETCh:SUBarrays:MODulation:PERRor:EPSK:CURRent?
FETCh:SUBarrays:MODulation:PERRor:EPSK:AVERage?
FETCh:SUBarrays:MODulation:PERRor:EPSK:MMAXimum?
Read meas. results (unsynchronized) *RUN*
SAMPle:SUBarrays:MODulation:PERRor:EPSK:CURRent?
SAMPle:SUBarrays:MODulation:PERRor:EPSK:AVERage?
SAMPle:SUBarrays:MODulation:PERRor:EPSK:MMAXimum?
Read results (synchronized) *RUN*

Ret. values per subrange	Description of parameters	Def. value	Def. unit	Unit ring
100.0 deg to+ 100.0 deg,	1st value for phase error	NAN	deg	
... ,	...	...	...	
–100.0 deg to+ 100.0 deg	nth value for phase error	NAN	deg	

Description of command	FW vers.
These commands are always queries. They measure and return the phase error versus time in the subranges defined by means of the `CONFigure:SUBarrays:MODulation:PERRor:EPSK` command. In the default setting of the configuration command the `READ:SUBarrays...`, `FETCh:SUBarrays...`, and `SAMPle:SUBarrays...` command group is equivalent to the `READ:ARRay...`, `FETCh:ARRay...`, and `SAMPle:ARRay...` command group described above. The `CONFigure:SUBarrays:MODulation:PERRor:EPSK` command defines a maximum of 32 subranges. If one of the statistical modes `(ARIThmetical, MINimum, MAXimum)` is set, only one value is returned per subrange. The calculation of *current*, *average*, *minimum*, and *maximum* results is explained in chapter 3 (see *display mode*).	V2.80

MODulation:MERRor

The subsystem *MODulation:MERRor* measures the magnitude error as well as general scalar modulation parameters. The subsystem corresponds to the measurement menu *Modulation,* application *Magn. Error 8PSK,* and the associated popup menu *Modulation Configuration.*

Important Note!

The keyword `:EPSK` *in the remote control commands of this section denotes 8PSK modulation. The commands are available with option CMU-K41 only.*

Control of Measurement – Subsystem MODulation:MERRor

The subsystem *MODulation:MERRor* controls the modulation measurement. It corresponds to the softkey *Magn. Error 8PSK* in the measurement menu *Modulation*.

INITiate:MODulation:MERRor:EPSK	Start new measurement	*RUN*
ABORt:MODulation:MERRor:EPSK	Abort running measurement and switch off	*OFF*
STOP:MODulation:MERRor:EPSK	Stop measurement after current stat. cycle	*STOP*
CONTinue:MODulation:MERRor:EPSK	Next measurement step (only *stepping mode*)	*RUN*
Description of command		FW vers.
These commands have no query form. They start and stop the modulation measurement, setting it to the status indicated in the top right column.		V2.80

CONFigure:MODulation:MERRor:EPSK:EREPorting *<Mode>*				Event Reporting
<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
SRQ | **SOPC |** **SRSQ |** **OFF**	Service request Single operation complete SRQ and SOPC No reporting	OFF	–	
Description of command				FW vers.
This command defines the events generated when the measurement is terminated or stopped (*event reporting,* see chapter 5 of CMU200 manual).				V2.80

FETCh:MODulation:MERRor:EPSK:STATus?				Measurement Status
Ret. values	Description of parameters	Def. value	Def. unit	Unit ring
OFF | **RUN |** **STOP |** **ERR |** **STEP |** **RDY,**	Measurement in the *OFF* state (`*RST` or `ABORt`) Running (after `INITiate, CONTinue` or `READ`) Stopped (`STOP`) *OFF* (could not be started) Stepping mode *(<stepmode>=STEP)* Stopped according to repetition mode and stop condition	OFF	–	
1 to 10000 | **NONE,**	Counter for current statistics cycle No counting mode set	NONE	–	
1 to 1000 | **NONE**	Counter for current evaluation period within a cycle Statistic count set to off	NONE	–	
Description of command				FW vers.
This command is always a query. It returns the status of the measurement (see chapters 3 and 5).				V2.80

Subsystem MODulation:MERRor:EPSK:CONTrol

The subsystem *MODulation:MERRor:EPSK:CONTrol* configures the modulation measurement. It corresponds to the tabs *Control* and *Statistics* in the popup menu *Modulation Configuration*.

CONFigure:MODulation:MERRor:EPSK:CONTrol *<Mode>, <Statistics>, <Repetition>, <StopCond>, <Stepmode>*				Scope of Measurement
<Mode>	Desciption of parameters	Def. value	Def. unit	Unit ring
SCALar | **ARRay,**	Scalar values only (incl. ramp matching) Scalar measured values and arrays	ARRay	–	–
<Statistics>	Description of parameters	Def. value	Def. unit	Unit ring
1 to 1000 | **NONE**	Number of bursts per statistics cycle Statistics off (equivalent to 1)	100	–	–
<Repetition>	Description of parameters	Def. value	Def. unit	Unit ring
CONTinuous | **SINGleshot |** **1 to 10000,**	Continuous measurement (until `STOP` or `ABORT`) Single shot measurement (until `Status = RDY`) Multiple measurement (*counting*, until `Status = STEP | RDY`)	SING	–	–
<StopCond>	Description of parameters	Def. value	Def. unit	Unit ring
SOERror | **NONE,**	Stop measurement in case of error *(stop on error)* Continue measurement even in case of error	NONE	–	–
<Stepmode>	Description of parameters	Def. value	Def. unit	Unit ring
STEP | **NONE**	Interrupt measurement after each statistics cycle Continue measurement according to its rep. mode	NONE	–	–
Description of command				FW-Vers.
This command defines the scope of the modulation measurement, combining the `...CONTrol:RMODe`, `...CONTrol:STATistics`, and the `...CONTrol: REPetition` commands (see below).				1.0

CONFigure:MODulation:MERRor:EPSK:CONTrol:RMODe *<Mode>* Result Mode

<Mode>	Desciption of parameters	Def. value	Def. unit	Unit ring
SCALar | **ARRay,**	Scalar values only (incl. ramp matching) Scalar measured values and arrays	ARRay	–	–

Description of command	FW-Vers.
This command specifies the type of measured values.	1.0

CONFigure:MODulation:MERRor:EPSK:CONTrol:STATistics *<Statistics>* Statistics Count

<Statistics>	Description of parameters	Def. value	Def. unit	Unit ring
1 to 1000 | **NONE**	Number of bursts per statistics cycle Statistics off (equivalent to 1)	100	–	–

Description of command	FW-Vers.
This command defines the number of bursts forming a statistics cycle.	1.0

CONFigure:MODulation:MERRor:EPSK:CONTrol:REPetition *<Repetition>* ,*<StopCond>*,*<Stepmode>* Test Cycles

<Repetition>	Description of parameters	Def. value	Def. unit	Unit ring
CONTinuous | **SINGleshot |** **1 to 10000**	Continuous measurement (until `STOP` or `ABORT`) Single shot measurement (until `Status = RDY`) Multiple measurement (*counting*, until `Status = STEP | RDY`)	SING	–	
<StopCond>	**Description of parameters**	**Def. value**	**Def. unit**	**Unit ring**
SOERror | **NONE**	Stop measurement in case of error *(stop on error)* Continue measurement even in case of error	NONE	–	
<Stepmode>	**Description of parameters**	**Def. value**	**Def. unit**	**Unit ring**
STEP | **NONE**	Interrupt measurement after each statistics cycle Continue measurement according to its rep. mode	NONE	–	

Description of command	FW vers.
This command determines the number of statistics cycles, the stop condition and the stepping mode for the measurement. **Note:** *In the case of READ commands (`READ:`...), the <Repetition> parameter has no effect; the measurement is always stopped after a single shot.*	V2.80

DEFault:MODulation:MERRor:EPSK:CONTrol *<Mode>* Default Settings

<Enable>	Description of parameters	Def. value	Def. unit	Unit ring
ON | **OFF**	The parameters are set to their default values Some or all parameters differ from the default values	ON	–	

Description of command	FW vers.
If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to their default values (the setting *OFF* has no effect). If used as a query the command returns whether all parameters are set to their default values *(ON)* or not *(OFF)*.	V2.80

Tolerance values – Subsystem MODulation:OEMP:EPSK:LIMit

The subsystem *MODulation:OEMP:EPSK:LIMit* (see p. 6.35 ff) defines tolerance values for the modulation measurement **in all four EPSK applications**. The subsystem corresponds to the *Limits* tab in the popup menu *Modulation Configuration.*

Subsystem SUBarrays:MODulation

The subsystem *SUBarrays:MODulation* defines the measurement range and the type of output values.

CONFigure:SUBarrays:MODulation:MERRor:EPSK
<Mode>,<Start>,<Samples>{,<Start>,<Samples>} Definition of Subarrays

<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
ALL | **ARIThmetical |** **MINimum |** **MAXimum,**	Return all measurement values Return arithm. mean value in every range Return minimum value in every range Return maximum value in every range	ALL	–	
<Start>	**Description of parameters**	**Def. value**	**Def. unit**	**Unit ring**
3 symb to 144 symb,	Start time in current range	0	symb	
<Samples>	**Description of parameters**	**Def. value**	**Def. unit**	**Unit ring**
0 to 142	Number of samples in current range	142	–	

Description of command	FW vers.
This command configures the `READ:SUBarrays...`, `FETCh:SUBarrays...`, and `SAMPle:SUBarrays:MODulation:MERRor:EPSK` commands. It restricts the measurement to up to 32 subranges where either all measurement results (the number of which is given by the second numerical parameter) or a single statistical value is returned. The subranges are defined by the start time and the number of test points which are located on a fixed, equidistant grid with a step width of 1 symb. The subranges may overlap but must be within the total range of the *Modulation* measurement. Test points outside this range are not measured (result *NAN)* and do not enter into the ARIThmetical, MINimum and MAXimum values. By default, only one range corresponding to the total measurement range is used and all measurement values are returned.	V2.80

Measured Values – Subsystem MODulation:MERRor:EPSK

The subsystem *MODulation:MERRor:EPSK* measures and returns the modulation parameters and compares them with the tolerance values. The subsystem corresponds to the various output elements in the measurement menu *MODulation,* application *Magn. Error 8PSK.*

READ[:SCALar]:MODulation:MERRor:EPSK? Scalar Results: Start single shot measurement and return results

FETCh[:SCALar]:MODulation:MERRor:EPSK? Read out meas. results (unsynchronized)

SAMPle[:SCALar]:MODulation:MERRor:EPSK? Read out measurement results (synchronized)

Returned values	Value range	Def. value	Def. unit	Unit ring
95thPercentileMErr	0.0 % to 100.0 %	NAN	%	
EVMPeak (x3),	0.0 % to 100.0 %	NAN	%	
EVMRMS (x3),	0.0 % to 100.0 %	NAN	%	
OriginOffset (x3),	–100.0 dB to +100.0 dB	NAN	dB	
IQImbalance (x3),	–100.0 dB to +100.0 dB	NAN	dB	
FrequencyError (x3),	–1000.0 Hz to +1000.0 Hz	NAN	Hz	
AvgBurstPowerCurr,	–100.0 dBm to +20.0 dBm	NAN	dBm	
AvgBurstPowerAvg	–100.0 dBm to +20.0 dBm	NAN	dBm	
BurstsOutOfTol	0.0 % to 100.0 %	NAN	%	

Description of command	FW vers.
These commands are always queries. They start a modulation measurement and output all scalar measurement results (see chapter 4), either for the whole burst or for the 1st ten valid symbols in the burst. The calculation of results in an *average* or *peak* measurement is described in chapter 3 (see *calculation of statistical quantities*). The symbol (x3) behind a value indicates that the list contains three results corresponding to the *Current*, the *Average*, and the *MMax* value.	V2.80

CALCulate[:SCALar]:MODulation:MERRor:EPSK:MATChing:LIMit? Bursts out of Tolerance

Returned values	Value range	Def. value	Def. unit	Unit ring
95thPercentileMErr		INV	–	
MErrPeak (x3),		INV	–	
MErrRMS (x3),	**For all measured values:**	INV	–	
		INV	–	
OriginOffset (x3),				
IQImbalance (x3),	**NMAU |NMAL | INV | OK**	INV	–	
FrequencyError (x3)		INV	–	

Description of command	FW vers.
This command is always a query. It indicates whether and in which way the error limits for the scalar measured values (see above command) have been exceeded. The symbol (x3) behind a value indicates that the list contains three results corresponding to the *Current*, the *Average*, and the *MMax* value. The limits are defined with the `CONFigure:MODulation:OEMP...` commands. The following messages may be output for all measured values: NMAU Underflow of tolerance value *not matching, underflow* NMAL Tolerance value exceeded *not matching, overflow* INV Measurement invalid *invalid* OK all tolerances matched	V2.80

READ:ARRay:MODulation:MERRor:EPSK:CURRent? Phase Error in Burst
READ:ARRay:MODulation:MERRor:EPSK:AVERage?
READ:ARRay:MODulation:MERRor:EPSK:MMAXimum?
Start single shot measurement and return results *RUN*
FETCh:ARRay:MODulation:MERRor:EPSK:CURRent?
FETCh:ARRay:MODulation:MERRor:EPSK:AVERage?
FETCh:ARRay:MODulation:MERRor:EPSK:MMAXimum?
Read measurement results (unsynchronized) *RUN*
SAMPle:ARRay:MODulation:MERRor:EPSK:CURRent?
SAMPle:ARRay:MODulation:MERRor:EPSK:AVERage?
SAMPle:ARRay:MODulation:MERRor:EPSK:MMAXimum?
Read measurement results (synchronized) *RUN*

Returned values	Description of parameters	Def. value	Def. unit	Unit ring
0.0 % to+ 100.0 %,	1st value for magnitude error	NAN	%	
... ,	...	...	...	
0.0 % to+ 100.0 %	142nd value for magnitude error	NAN	%	

Description of command	FW vers.
These commands are always queries. They return the magnitude error vs. time at fixed, equidistant test points. The number of measured values is 142, corresponding to a time range of 3 symb to 144 symb. The calculation of *current, average, and mmax* (Min./Max.) results is explained in chapter 3 (see *display mode*).	V2.80

READ:SUBarrays:MODulation:MERRor:EPSK:CURRent? Subarray Results
READ:SUBarrays:MODulation:MERRor:EPSK:AVERage?
READ:SUBarrays:MODulation:MERRor:EPSK:MMAXimum?
Start single shot measurement and return results *RUN*
FETCh:SUBarrays:MODulation:MERRor:EPSK:CURRent?
FETCh:SUBarrays:MODulation:MERRor:EPSK:AVERage?
FETCh:SUBarrays:MODulation:MERRor:EPSK:MMAXimum?
Read meas. results (unsynchronized) *RUN*
SAMPle:SUBarrays:MODulation:MERRor:EPSK:CURRent?
SAMPle:SUBarrays:MODulation:MERRor:EPSK:AVERage?
SAMPle:SUBarrays:MODulation:MERRor:EPSK:MMAXimum?
Read results (synchronized) *RUN*

Ret. values per subrange	Description of parameters	Def. value	Def. unit	Unit ring
0.0 % to+ 100.0 %,	1st value for magnitude error	NAN	%	
... ,	...	...	...	
0.0 % to+ 100.0 %	nth value for magnitude error	NAN	%	

Description of command	FW vers.
These commands are always queries. They measure and return the magnitude error versus time in the subranges defined by means of the `CONFigure:SUBarrays:MODulation:MERRor:EPSK` command. In the default setting of the configuration command the `READ:SUBarrays...`, `FETCh:SUBarrays...`, and `SAMPle:SUBarrays...` command group is equivalent to the `READ:ARRay...`, `FETCh:ARRay...`, and `SAMPle:ARRay...` command group described above. The `CONFigure:SUBarrays:MODulation:MERRor:EPSK` command defines a maximum of 32 subranges. If one of the statistical modes `(ARIThmetical, MINimum, MAXimum)` is set, only one value is returned per subrange. The calculation of *current, average, minimum,* and *maximum* results is explained in chapter 3 (see *display mode*).	V2.80

Test Object SPECtrum[:COMMon]

The subsystem *SPECtrum[:COMMon]* provides settings that are common to the two applic*ations Spectrum due to Modulation* (see p. 6.58 ff) and *Spectrum due to Switching* (see p. 6.67 ff).

CONFigure:SPECtrum[:COMMon]:NOISe:CORRection <*Enable*>				Noise Correction
<Enable>	Description of parameters	Def. value	Def. unit	Unit ring
ON | OFF	Switch noise correction on or off	ON	–	–
Description of command				FW vers.
This command switches the noise correction for the Spectrum measurement on or off. The noise correction improves the dynamic range but slightly reduces the speed of the measurement.				V2.80

SPECtrum due to Modulation

The subsystem *SPECtrum:MODulation* measures the off-carrier power due to the modulation of the GSM signal. The subsystem corresponds to the measurement menus *Spectrum,* application *due to Modulation,* and the associated configuration popups.

Important Note!

The keywords `:GMSK` *and* `:EPSK` *in the remote control commands denote GMSK and 8PSK modulation, respectively. The* `:EPSK` *commands are available with option CMU-K41 only.*

Control of Measurement – Subsystem SPECtrum due to MODulation

The subsystem *SPECtrum:MODulation* controls the spectrum measurement.

INITiate:SPECtrum:MODulation:GMSK **INITiate:SPECtrum:MODulation:EPSK**	Start new measurement	*RUN*
ABORt:SPECtrum:MODulation:GMSK **ABORt:SPECtrum:MODulation:EPSK**	Abort running meas. and switch off	*OFF*
STOP:SPECtrum:MODulation:GMSK **STOP:SPECtrum:MODulation:EPSK**	Stop meas. after current stat. cycle	*STOP*
CONTinue:SPECtrum:MODulation:GMSK **CONTinue:SPECtrum:MODulation:EPSK**	Next meas. step (only *stepping mode*)	*RUN*
Description of command		FW vers.
These commands have no query form. They start or stop the measurement, setting it to the status indicated in the top right column.		V2.80

CONFigure:SPECtrum:MODulation:GMSK:EREPorting *<Mode>*
CONFigure:SPECtrum:MODulation:EPSK:EREPorting *<Mode>* Event Reporting

<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
SRQ | **SOPC |** **SRSQ |** **OFF**	Service request Single operation complete SRQ and SOPC No reporting	OFF	–	–

Description of command	FW vers.
This command defines the events generated when the measurement is terminated or stopped *(event reporting*, see chapter 5 of CMU200 manual).	V2.80

FETCh:SPECtrum:MODulation:GMSK:STATus?
FETCh:SPECtrum:MODulation:EPSK:STATus? Measurement Status

Return	Description of parameters	Def. value	Def. unit	Unit ring
OFF | **RUN |** **STOP |** **ERR |** **STEP |** **RDY,**	Measurement in the *OFF* state (`*RST` or `ABORt`) Running (after `INITiate`, `CONTinue` or `READ`) Stopped (`STOP`) *OFF* (could not be started) Stepping mode *(<stepmode>=STEP)* Stopped according to repetition mode and stop condition	OFF	–	–
1 to 10000 | **NONE,**	Counter for current statistics cycle No counting mode set	NONE	–	–
1 to 1000 | **NONE**	Counter for current evaluation period within a cycle Statistic count set to off	NONE	–	–

Description of command	FW vers.
This command is always a query. It returns the status of the measurement (see chapters 3 and 5).	V2.80

Subsystem SPECtrum:MODulation...:CONTrol

The subsystem *SPECtrum:MODulation...:CONTrol* defines the repetition mode, statistic count, and stop condition of the measurement. These settings are provided in the *Control* and *Statistics* tabs in the popup menu *Spectrum Configuration.*

CONFigure:SPECtrum:MODulation:GMSK:CONTrol *<Mode>, <Statistics>, <Repetition>, <StopCond>, <Stepmode>* Scope of Measurement
CONFigure:SPECtrum:MODulation:EPSK:CONTrol *<Mode>, <Statistics>, <Repetition>, <StopCond>, <Stepmode>*

<Mode>	Desciption of parameters	Def. value	Def. unit	Unit ring
SCALar | **ARRay,**	Scalar values only (incl. ramp matching) Scalar measured values and arrays	ARRay	–	–

<Statistics>	Description of parameters	Def. value	Def. unit	Unit ring
1 to 1000 | **NONE**	Number of bursts per statistics cycle Statistics off (equivalent to 1)	100	–	–
<Repetition>	Description of parameters	Def. value	Def. unit	Unit ring
CONTinuous | **SINGleshot |** **1 to 10000,**	Continuous measurement (until `STOP` or `ABORT`) Single shot measurement (until `Status = RDY`) Multiple measurement (*counting*, until `Status = STEP | RDY`)	SING	–	–
<StopCond>	Description of parameters	Def. value	Def. unit	Unit ring
SOERror | **NONE,**	Stop measurement in case of error *(stop on error)* Continue measurement even in case of error	NONE	–	–
<Stepmode>	Description of parameters	Def. value	Def. unit	Unit ring
STEP | **NONE**	Interrupt measurement after each statistics cycle Continue measurement according to its rep. mode	NONE	–	–
Description of command				FW-Vers.
This command defines the scope of the spectrum measurement, combining the `...CONTrol:RMODe`, `...CONTrol:STATistics`, and the `...CONTrol: REPetition` commands (see below).				1.0

CONFigure:SPECtrum:MODulation:GMSK:CONTrol:RMODe *<Mode>* Result Mode
CONFigure:SPECtrum:MODulation:EPSK:CONTrol:RMODe *<Mode>*

<Mode>	Desciption of parameters	Def. value	Def. unit	Unit ring
SCALar | **ARRay,**	Scalar values only (incl. ramp matching) Scalar measured values and arrays	ARRay	–	–
Description of command				FW-Vers.
This command specifies the type of measured values.				1.0

CONFigure:SPECtrum:MODulation:GMSK:CONTrol:STATistics *<Statistics>* Statistics Count
CONFigure:SPECtrum:MODulation:EPSK:CONTrol:STATistics *<Statistics>*

<Statistics>	Description of parameters	Def. value	Def. unit	Unit ring
1 to 1000 | **NONE**	Number of bursts per statistics cycle Statistics off (equivalent to 1)	100	–	–
Description of command				FW-Vers.
This command defines the number of bursts forming a statistics cycle.				1.0

CONFigure:SPECtrum:MODulation:GMSK:CONTrol:REPetition
CONFigure:SPECtrum:MODulation:EPSK:CONTrol:REPetition
<Repetition>,<StopCondition>,<Stepmode>

Test cycles

<Repetition>	Description of parameters	Def. value	Def. unit	Unit ring
CONTinuous | **SINGleshot |** **1 to 10000,**	Continuous measurement (*continuous*, until `STOP` or `ABORT`) Single measurement (*single shot*, `until Status = RDY`) Multiple measurement (*counting*, until `Status = STEP | RDY`)	SING	–	–
<StopCondition>	**Description of parameters**	**Def. value**	**Def. unit**	**Unit ring**
SOERror | **NONE,**	Stop measurement in case of error *(stop on error)* Continue measurement even in case of error	NONE	–	–
<Stepmode>	**Description of parameters**	**Def. value**	**Def. unit**	**Unit ring**
STEP | **NONE**	Interrupt measurement after each statistics cycle Continue measurement according to its rep. mode	NONE	–	–

Description of command	FW vers.
This command defines the number of test cycles, the stepping mode and, if required, a stop condition for the measurement. **Note:** *In the case of READ commands (`READ:...`), the <Repetition> parameter has no effect; the measurement is always stopped after a single shot.*	V2.80

DEFault:SPECtrum:MODulation:GMSK:CONTrol *<Enable>*
DEFault:SPECtrum:MODulation:EPSK:CONTrol *<Enable>*

Default Settings

<Enable>	Description of parameters	Def. value	Def. unit	Unit ring
ON | **OFF**	All parameters are set to their default values Some or all parameters differ from the default values	ON	–	

Description of command	FW vers.
If used with *ON*, this command sets all the parameters of the subsystem to their default values. (*OFF* has no effect). In the query format, the command returns *ON* if all the parameters of the subsystem correspond to their default values, otherwise it returns *OFF*.	V2.80

Test Configuration

The commands of the following subsystems configure the spectrum due to modulation. They correspond to the *due to Modulation* sections in the *Spectrum Configuration* menu.

Subsystem SPECTrum:MODulation...:LIMit:LINE

The subsystem *SPECtrum:MODulation...:LIMit:LINE* defines the limit lines, i.e. the tolerance values for the spectrum measurement. The subsystem corresponds to the tab *Limit Lines* in the popup menu *Spectrum Configuration.*

Limits

CONFigure:SPECtrum:MODulation:GMSK:LIMit:LINE:SYMMetric[:COMBined]:FREQuency<nr>
CONFigure:SPECtrum:MODulation:EPSK:LIMit:LINE:SYMMetric[:COMBined]:FREQuency<nr>
<MinPwLevelRel>, <MaxPwLevelRel>, <AbsPwLevel>, <Enable>
CONFigure:SPECtrum:MODulation:GMSK:LIMit:LINE:SYMMetric[:COMBined]
:FREQuency<nr>:ENABle *<Enable>*
CONFigure:SPECtrum:MODulation:EPSK:LIMit:LINE:SYMMetric[:COMBined]
:FREQuency<nr>:ENABle *<Enable>*
CONFigure:SPECtrum:MODulation:GMSK:LIMit:LINE:SYMMetric[:COMBined]
:FREQuency<nr>:VALue
CONFigure:SPECtrum:MODulation:EPSK:LIMit:LINE:SYMMetric[:COMBined]
:FREQuency<nr>:VALue
<MinPwLevelRel>, <MaxPwLevelRel>, <AbsPwLevel>

Numeric Suffix	Value range	Description of parameters	Def. value
<nr>	1 to11	Measurement point (frequency) no.	
Parameters	Value range	Description of parameters	Def. value
<Enable>	ON | OFF	Limit check for frequency point <nr> on/off	See below
<MinPwLevelRel>,	–99.9 dB to 99.9 dB	Limit for relative power below the interpolation range	
<MaxPwLevelRel>,	–99.9 dB to 99.9 dB	Limit for relative power above the interpolation range	
<AbsPwLevel>,	–99.9 dBm to 99.9 dBm	Alternative absolute power limit	

Description of command

FW vers.

V2.80

These commands activate and define limit lines for the spectrum due to modulation measurement.

The limits are defined at up to 11 fixed frequencies numbered by the numeric suffix <nr> and as a function of the BTS output power level. Outside the interpolation range defined via `CONFigure:SPECtrum:MODulation:GMSK:LIMit:LINE:SYMMetric [:COMBined]:RPOWer`, the fixed relative power limits *<MinPwLevelRel> and <MaxPwLevelRel>* apply. Inside this range, the limits are derived from these values by linear interpolation. As an alternative, an absolute power limit is set. For a more detailed explanation see chapter 4.

To switch on or off the entire limit check please use the command

```
CONFigure:SPECtrum:MODulation:GMSK:LIMit:LINE:SYMMetric
[:COMBined]:ENABle <Mode>
```

Default values for GSM400/900 (the GSM1800/1900 values are given in brackets where they differ from the GSM400/900 values): 1.0

Frequency	Min.P. Lev.rel.	Max.P. Lev.rel.	Level abs.
± 0.10 MHz	+0.5 dB	+ 0.5 dB	–65.0 dBm (–57.0 dBm)
± 0.20 MHz	–30.0 dB	– 30.0 dB	–65.0 dBm (–57.0 dBm)
± 0.25 MHz	–33.0 dB	– 33.0 dB	–65.0 dBm (–57.0 dBm)
± 0.40 MHz	–60.0 dB[1]	– 60.0 dB[1]	–65.0 dBm (–57.0 dBm)
± 0.60 MHz	–60.0 dB	– 70.0 dB	–65.0 dBm (–57.0 dBm)
± 0.80 MHz	–60.0 dB	– 70.0 dB	–65.0 dBm (–57.0 dBm)
± 1.00 MHz	–60.0 dB	– 70.0 dB	–65.0 dBm (–57.0 dBm)
± 1.20 MHz	–63.0 dB	– 73.0 dB	–65.0 dBm (–57.0 dBm)
± 1.40 MHz	–63.0 dB	– 73.0 dB	–65.0 dBm (–57.0 dBm)
± 1.60 MHz	–63.0 dB	– 73.0 dB	–65.0 dBm (–57.0 dBm)
± 1.80 MHz	–63.0 dB	– 73.0 dB	–65.0 dBm (–57.0 dBm)

CONFigure:SPECtrum:MODulation:GMSK:LIMit:LINE:SYMMetric[:COMBined]:RPOWer
CONFigure:SPECtrum:MODulation:EPSK:LIMit:LINE:SYMMetric[:COMBined]:RPOWer
<Minimum>, <Maximum> Reference Power

<Minimum>	Description of parameters	Def. value	Def. unit	Unit ring
–99.9 dBm to +99.9 dBm	Ref. power for min. power level	33	dBm	–
<Maximum>	Description of parameters	Def. value	Def. unit	Unit ring
–99.9 dBm to +99.9 dBm	Ref. power for max. power level	43	dBm	–

Description of command	FW vers.
This command defines the BTS output power range where the relative limit lines are given by linear interpolation between a minimum and a maximum relative power level. See command `CONFigure:SPECtrum:MODulation:...LIMit:LINE:SYMMetric[:COMBined]:FREQuency<nr>:VALue` and detailed explanation in chapter 4.	V2.80

CONFigure:SPECtrum:MODulation:GMSK:LIMit:LINE:SYMMetric[:COMBined]:ENABle *<Mode>*
CONFigure:SPECtrum:MODulation:EPSK:LIMit:LINE:SYMMetric[:COMBined]:ENABle *<Mode>*
Limits on/off

<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
ON | **OFF**	Switch on limit check Switch off limit check	ON	–	–

Description of command	FW vers.
This command switches the limit check for all measurement points on or off.	V2.80

DEFault:SPECtrum:MODulation:GMSK:LIMit:LINE *<Enable>*
DEFault:SPECtrum:MODulation:EPSK:LIMit:LINE *<Enable>* Default Settings

<Enable>	Description of parameters	Def. value	Def. unit	Unit ring
ON | **OFF**	All parameters are set to their default values Some or all parameters differ from the default values	ON	–	

Description of command	FW vers.
If used as a setting command with *ON*, this command sets all the parameters of the subsystem to their default values. (*OFF* has no effect). In the query format, the command returns *ON* if all the parameters of the subsystem correspond to their default values, otherwise it returns *OFF*.	V2.80

---

[1] GMSK modulation. With 8PSK modulation, the corresponding value is –56.0 dB.

Subsystem SPECTrum:MODulation...:MPOint<nr>

The subsystem *SPECtrum:MODulation...:MPOint<nr>* defines at which frequencies the *Spectrum* measurement is performed. The subsystem corresponds to the tab *Meas X* in the popup menu *Spectrum Configuration.*

CONFigure:SPECtrum:MODulation:GMSK:MPOint<nr>:ENABle <Enable>
CONFigure:SPECtrum:MODulation:EPSK:MPOint<nr>:ENABle <Enable>
Enable/Disable Measurement Points

<Enable>	Description of parameters	Def. value	Def. unit	Unit ring
ON | **OFF**	Switch on measurement point <nr> Switch off measurement point <nr>	ON	–	–

Description of command	FW vers.
This command switches the measurement at the individual frequency points no. 1 to 11 (numbered by the numeric suffix <nr>) on or off.	V2.80

Subsystem SUBarrays:SPECtrum:MODulation

The subsystem *SUBarrays:SPECtrum:MODulation* defines the measurement range and the type of output values.

CONFigure:SUBarrays:SPECtrum:MODulation:GMSK
CONFigure:SUBarrays:SPECtrum:MODulation:EPSK
<Mode>,<Start>,<Samples>{,<Start>,<Samples>} Definition of Subarrays

<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
ALL | **ARIThmetical |** **MINimum |** **MAXimum,**	Return all measurement values Return arithm. mean value in every range Return minimum value in every range Return maximum value in every range	ALL	–	
<Start>	Description of parameters	Def. value	Def. unit	Unit ring
–1.8 MHz to 1.8 MHz,	Frequency of first point in current range	–1.8	MHz	
<Samples>	Description of parameters	Def. value	Def. unit	Unit ring
1 to 23	Number of samples in current range	23	–	

Description of command	FW vers.
This command configures the `READ:SUBarrays..`, `FETCh:SUBarrays..`, and `SAMPle:SUBarrays:SPECtrum:MODulation...` commands. It restricts the measurement to up to 32 subranges where either all measurement results (the number of which is given by the second numerical parameter) or a single statistical value is returned. The subranges are defined by the start frequency and the number of test points which are located at fixed frequencies (see command `CONFigure:SPECtrum:MODulation:...:LIMit:LINE:SYMMetric[:COMBined]:FREQuency<nr>`). The subranges may overlap but must be within the total range of the spectrum due to modulation measurement. Test points outside this range are not measured (result NAN) and do not enter into the ARIThmetical, MINimum and MAXimum values. By default, only one range corresponding to the total measurement range is used and all measurement values are returned.	V2.80

Measured Values

The commands of the following subsystems determine and return the results of the spectrum due to modulation measurement. They correspond to the graphical menu *Spectrum* with its various display elements.

Subsystem SPECtrum:MODulation...

The subsystem *SPECtrum:MODulation...* measures and returns of the frequency spectrum (due to modulation) and compares it with tolerance values. The subsystem corresponds to the graphical measurement menu *Spectrum*.

READ[:SCALar]:SPECtrum:MODulation:GMSK? Scalar Results
READ[:SCALar]:SPECtrum:MODulation:EPSK? Start single shot measurement and return results
FETCh[:SCALar]:SPECtrum:MODulation:GMSK?
FETCh[:SCALar]:SPECtrum:MODulation:EPSK? Read measurement results unsynchronized
SAMPle[:SCALar]:SPECtrum:MODulation:GMSK?
SAMPle[:SCALar]:SPECtrum:MODulation:EPSK? Read measurement results synchronized

Return	Value range	Def. value	Def. unit	Unit ring
Reference Power,	–100.0 dBm to +20.0 dBm	NAN	dBm	
Matching	INV | MATC | NMAT | NTSC | OUT | NTRG | UFLW | OFLW	INV	–	

Description of command	FW vers.
These commands are always queries.	V2.80

These commands are always queries.

- `READ` starts a single shot measurement and returns the results.
- `FETCh` outputs the results without taking care of the measurement state.
- `SAMPle` waits until the results are valid for the first time (depending on the chosen statistic count) and then outputs the results.

For more details refer to the description of measurement control in chapter 5 of the CMU200 operating manual.

The reference power is the absolute carrier power measured as specified in the GSM standard. The following messages may be output for the value *Matching*:

MATC	*matching*
NMAT	*not matching*
INV	*invalid*
NTSC	*no training sequence code*
OUT	*out of range*
NTRG	*not triggered*
UFLW	*underflow*
OFLW	*overflow*

READ:ARRay:SPECtrum:MODulation:GMSK? Spectrum Results
READ:ARRay:SPECtrum:MODulation:EPSK? Start single shot measurement and return results
FETCh:ARRay:SPECtrum:MODulation:GMSK?
FETCh:ARRay:SPECtrum:MODulation:EPSK? Read measurement results (unsynchronized)
SAMPle:ARRay:SPECtrum:MODulation:GMSK?
SAMPle:ARRay:SPECtrum:MODulation:EPSK? Read results (synchronized)

Return	Description of parameters	Def. value	Def. unit	Unit ring
–100.0 dBm to + 20.0 dBm,	Power at measurement point 1,	NAN	dBm	FG
...,	...,	...	...	Power
–100.0 dBm to + 20.0 dBm	Power at measurement point 23	NAN	dBm	Level

Description of command	FW vers.
These commands are always queries. They return the off-carrier power due to modulation at all measurement points.	V2.80

READ:SUBarrays:SPECtrum:MODulation:GMSK?
READ:SUBarrays:SPECtrum:MODulation:EPSK? Subarray Results
Start single shot measurement and return results *RUN*
FETCh:SUBarrays:SPECtrum:MODulation:GMSK?
FETCh:SUBarrays:SPECtrum:MODulation:EPSK?
Read meas. results (unsynchronized) *RUN*
SAMPle:SUBarrays:SPECtrum:MODulation:GMSK?
SAMPle:SUBarrays:SPECtrum:MODulation:EPSK?
Read results (synchronized) *RUN*

Ret. values per subrange	Description of parameters	Def. value	Def. unit	Unit ring
–100.0 dBm to + 20.0 dBm,	Power at measurement point 1,	NAN	dB	
...,	...,	...	...	
–100.0 dBm to + 20.0 dBm	Power at measurement point n	NAN	dB	

Description of command	FW vers.
These commands are always queries. They output the off-carrier power due to modulation in the subranges defined by means of the `CONFigure:SUBarrays:SPECtrum:MODulation:GMSK|EPSK` command. In the default setting of the configuration command the `READ:SUBarrays...`, `FETCh:SUBarrays...`, and `SAMPle:SUBarrays...` command group is equivalent to the `READ:ARRay...`, `FETCh:ARRay...`, and `SAMPle:ARRay...` command group described above. The `CONFigure:SUBarrays:SPECtrum:MODulation:GMSK|EPSK` command defines a maximum of 32 subranges. If one of the statistical modes (`ARIThmetical`, `MINimum`, `MAXimum`) is set, only one value is returned per subrange.	V2.80

SPECtrum due to SWITching

The subsystem *SPECtrum:SWITching* measures the off-carrier power due to the bursty nature of the GSM signal. The subsystem corresponds to the measurement menu *Spectrum* and the associated configuration popups

Important Note!

The keywords `:GMSK` and `:EPSK` in the remote control commands denote GMSK and 8PSK modulation, respectively. The `:EPSK` commands are available with option CMU-K41 only.

Control of Measurement – Subsystem SPECtrum:SWITching

The subsystem *SPECtrum:SWITching* controls the spectrum measurement.

INITiate:SPECtrum:SWITching:GMSK **INITiate:SPECtrum:SWITching:EPSK**	Start new measurement	*RUN*
ABORt:SPECtrum:SWITching:GMSK **ABORt:SPECtrum:SWITching:EPSK**	Abort running measurement and switch off	*OFF*
STOP:SPECtrum:SWITching:GMSK **STOP:SPECtrum:SWITching:EPSK**	Stop measurement after current stat. cycle	*STOP*
CONTinue:SPECtrum:SWITching:GMSK **CONTinue:SPECtrum:SWITching:EPSK**	Next measurement step (only *stepping mode*)	*RUN*

Description of command	FW vers.
These commands have no query form. They start or stop the measurement, setting it to the status indicated in the top right column.	V2.80

CONFigure:SPECtrum:SWITching:GMSK:EREPorting <*Mode*>
CONFigure:SPECtrum:SWITching:EPSK:EREPorting <*Mode*> Event Reporting

<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
SRQ |	Service request	OFF	–	–
SOPC |	Single operation complete			
SRSQ |	SRQ and SOPC			
OFF	No reporting			

Description of command	FW vers.
This command defines the events generated when the measurement is terminated or stopped *(event reporting,* see chapter 5 of CMU200 manual).	V2.80

FETCh:SPECtrum:SWITching:GMSK:STATus?
FETCh:SPECtrum:SWITching:EPSK:STATus? Measurement Status

Return	Description of parameters	Def. value	Def. unit	Unit ring
OFF | **RUN |** **STOP |** **ERR |** **STEP |** **RDY,**	Measurement in the *OFF* state (`*RST` or `ABORt`) Running (after `INITiate, CONTinue` or `READ`) Stopped (`STOP`) *OFF* (could not be started) Stepping mode *(<stepmode>=STEP)* Stopped according to repetition mode and stop condition	OFF	–	–
1 to 10000 | **NONE,**	Counter for current statistics cycle No counting mode set	NONE	–	–
1 to 1000 | **NONE**	Counter for current evaluation period within a cycle Statistic count set to off	NONE	–	–

Description of command	FW vers.
This command is always a query. It returns the status of the measurement (see chapters 3 and 5).	V2.80

Subsystem SPECtrum:SWITching...:CONTrol

The subsystem *SPECtrum:SWITching...:CONTrol* defines the repetition mode, statistic count, and stop condition of the measurement. These settings are provided in the *Control* and *Statistics* tabs in the popup menu *Spectrum Configuration*.

CONFigure:SPECtrum:SWITching:GMSK:CONTrol *<Mode>, <Statistics>, <Repetition>, <StopCond>, <Stepmode>* Scope of Measurement
CONFigure:SPECtrum:SWITching:EPSK:CONTrol *<Mode>, <Statistics>, <Repetition>, <StopCond>, <Stepmode>*

<Mode>	Desciption of parameters	Def. value	Def. unit	Unit ring
SCALar | **ARRay,**	Scalar values only (incl. ramp matching) Scalar measured values and arrays	ARRay	–	–
<Statistics>	Description of parameters	Def. value	Def. unit	Unit ring
1 to 1000 | **NONE**	Number of bursts per statistics cycle Statistics off (equivalent to 1)	100	–	–
<Repetition>	Description of parameters	Def. value	Def. unit	Unit ring
CONTinuous | **SINGleshot |** **1 to 10000,**	Continuous measurement (until `STOP` or `ABORT`) Single shot measurement (until `Status = RDY`) Multiple measurement (*counting*, until `Status = STEP | RDY`)	SING	–	–
<StopCond>	Description of parameters	Def. value	Def. unit	Unit ring
SOERror | **NONE,**	Stop measurement in case of error *(stop on error)* Continue measurement even in case of error	NONE	–	–
<Stepmode>	Description of parameters	Def. value	Def. unit	Unit ring
STEP | **NONE**	Interrupt measurement after each statistics cycle Continue measurement according to its rep. mode	NONE	–	–

Description of command	FW-Vers.
This command defines the scope of the power measurement, combining the `...CONTrol:RMODe`, `...CONTrol:STATistics`, and the `...CONTrol: REPetition` commands (see below).	1.0

CONFigure:SPECtrum:SWITching:GMSK:CONTrol:RMODe *<Mode>* Result Mode
CONFigure:SPECtrum:SWITching:EPSK:CONTrol:RMODe *<Mode>*

<Mode>	Desciption of parameters	Def. value	Def. unit	Unit ring
SCALar |	Scalar values only (incl. ramp matching)	ARRay	–	–
ARRay,	Scalar measured values and arrays			

Description of command	FW-Vers.
This command specifies the type of measured values.	1.0

CONFigure:SPECtrum:SWITching:GMSK:CONTrol:STATistics *<Statistics>* Statistics Count
CONFigure:SPECtrum:SWITching:EPSK:CONTrol:STATistics *<Statistics>*

<Statistics>	Description of parameters	Def. value	Def. unit	Unit ring
1 to 1000 |	Number of bursts per statistics cycle	100	–	–
NONE	Statistics off (equivalent to 1)			

Description of command	FW-Vers.
This command defines the number of bursts forming a statistics cycle.	1.0

CONFigure:SPECtrum:SWITching:GMSK:CONTrol:REPetition
CONFigure:SPECtrum:SWITching:EPSK:CONTrol:REPetition Test Cycles
<Repetition>,<StopCondition>, <Stepmode>

<Repetition>	Description of parameters	Def. value	Def. unit	Unit ring
CONTinuous |	Continuous measurement (until `STOP` or `ABORT`)	SING	–	–
SINGleshot |	Single shot measurement (until `Status = RDY`)			
1 to 10000,	Multiple measurement (*counting*, until `Status = STEP | RDY`)			

<StopCondition>	Description of parameters	Def. value	Def. unit	Unit ring
SOERror |	Stop measurement in case of error *(stop on error)*	NONE	–	–
NONE,	Continue measurement even in case of error			

<Stepmode>	Description of parameters	Def. value	Def. unit	Unit ring
STEP |	Interrupt measurement after each statistics cycle	NONE	–	–
NONE	Continue measurement according to its rep. mode			

Description of command	FW vers.
This command defines the number of test cycles, the stepping mode and, if required, an stop condition for the measurement. **Note:** *In the case of READ commands (`READ:...`), the <Repetition> parameter has no effect; the measurement is always stopped after a single shot*	V2.80

DEFault:SPECtrum:SWITching:GMSK:CONTrol *<Enable>*
DEFault:SPECtrum:SWITching:EPSK:CONTrol *<Enable>* Default Settings

<Enable>	Description of parameters	Def. value	Def. unit	Unit ring
ON | **OFF**	All parameters are set to their default values Some or all parameters differ from the default values	ON	–	

Description of command	FW vers.
If used with *ON*, this command sets all the parameters of the subsystem to their default values. (*OFF* has no effect). In the query format, the command returns *ON* if all the parameters of the subsystem correspond to their default values, otherwise it returns *OFF*.	V2.80

Test Configuration

The commands of the following subsystems configure the spectrum due to switching. They correspond to the *due to Switching* sections in the *Spectrum Configuration* menu.

Subsystem SPECTrum:SWITching...:LIMit:LINE

The subsystem *SPECtrum:SWITching...:LIMit:LINE* defines the limit lines, i.e. the tolerance values for the spectrum measurement. The subsystem corresponds to the tab *Limit Lines* in the popup menu *Spectrum Configuration.*

CONFigure:SPECtrum:SWITching:GMSK:LIMit:LINE:SYMMetric[:COMBined]:FREQuency<nr> Limits
CONFigure:SPECtrum:SWITching:EPSK:LIMit:LINE:SYMMetric[:COMBined]:FREQuency<nr>
<MinPwLevelRel>, <MaxPwLevelRel>, <AbsPwLevel>, <Enable>
CONFigure:SPECtrum:SWITching:GMSK:LIMit:LINE:SYMMetric[:COMBined]:FREQuency<nr>:ENABle *<Enable>*
CONFigure:SPECtrum:SWITching:EPSK:LIMit:LINE:SYMMetric[:COMBined]:FREQuency<nr>:ENABle *<Enable>*
CONFigure:SPECtrum:SWITching:GMSK:LIMit:LINE:SYMMetric[:COMBined]:FREQuency<nr>:VALue
CONFigure:SPECtrum:SWITching:EPSK:LIMit:LINE:SYMMetric[:COMBined]:FREQuency<nr>:VALue
<MinPwLevelRel>, <MaxPwLevelRel>, <AbsPwLevel>

<nr>	Description of parameters	Def. value	Def. unit	Unit ring
1 to 4	Number of the measurement point	1	–	–
<Rel>	Description of parameters	Def. value	Def. unit	Unit ring
–99.9 dBc to 25 dBc	Relative limit for the measure point	see below	dBc	–
<Abs>	Description of parameters	Def. value	Def. unit	Unit ring
-99.9 dBm .. 50 dBm	The absolute limit for the measure point	–36	dBm	–
<Enable>	Description of parameters	Def. value	Def. unit	Unit ring
ON | **OFF**	Switch on limit check Switch off limit check	ON	–	–

Description of command	FW vers.
These commands activate and define limit lines for the spectrum due to switching measurement.	V2.80

The relative limits depend on the GSM band and on the measurement points numbered by the numeric suffix <nr>.

For totally switching on or off the limit check please use the command

`CONFigure:SPECtrum:SWITching:GMSK:LIMit:LINE:SYMMetric[:COMBined]:ENABle <Mode>`

Default values for the four GSM bands (all in dBc):

Meas. point	Frequ. offset	GSM400/900	GSM1800	GSM1900
1	0.4 MHz	–57[2]	–50	–50
2	0.6 MHz	–67[3]	–58	–58
3	1.2 MHz	–74	–66	–66
4	1.8 MHz	–74	–66	–66

CONFigure:SPECtrum:SWITching:GMSK:LIMit:LINE:SYMMetric[:COMBined]:ENABle *<Mode>*
CONFigure:SPECtrum:SWITching:EPSK:LIMit:LINE:SYMMetric[:COMBined]:ENABle *<Mode>*
Limit Check on/off

<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
ON |	Switch on limit check	ON	–	–
OFF	Switch off limit check			

Description of command	FW vers.
This command switches the limit check for all measurement points on or off.	V2.80

DEFault:SPECtrum:SWITching:GMSK:LIMit:LINE *<Enable>*
DEFault:SPECtrum:SWITching:EPSK:LIMit:LINE *<Enable>* Default Settings

<Enable>	Description of parameters	Def. value	Def. unit	Unit ring
ON |	All parameters are set to their default values	ON	–	
OFF	Some or all parameters differ from the default values			

Description of command	FW vers.
If used with *ON*, this command sets all the parameters of the subsystem to their default values. (*OFF* has no effect). In the query format, the command returns *ON* if all the parameters of the subsystem correspond to their default values, otherwise it returns *OFF*.	V2.80

Subsystem SPECTrum:SWITching...:MPOint<nr>

The subsystem *SPECtrum:SWITching...:MPOint<nr>* defines at which frequencies the *Spectrum* measurement is performed. The subsystem corresponds to the tab *Meas X* in the popup menu *Spectrum Configuration.*

---

[2] GMSK modulation. With 8PSK modulation, the corresponding value is –52.0 dBc.

[3] GMSK modulation. With 8PSK modulation, the corresponding value is –62.0 dBc.

CONFigure:SPECtrum:SWITching:GMSK:MPOint<nr>:ENABle <Enable>
CONFigure:SPECtrum:SWITching:EPSK:MPOint<nr>:ENABle <Enable>
Enable/Disable Measurement Points

<Enable>	Description of parameters	Def. value	Def. unit	Unit ring
ON |	Switch on measurement point <nr>	ON	–	–
OFF	Switch off measurement point <nr>			

Description of command	FW vers.
This command switches the measurement at the individual frequency points no. 1 to 4 (numbered by the numeric suffix <nr>) on or off.	V2.80

Subsystem SUBarrays:SPECtrum:SWITching

The subsystem *SUBarrays:SPECtrum:SWITching* defines the measurement range and the type of output values.

CONFigure:SUBarrays:SPECtrum:SWITching:GMSK
CONFigure:SUBarrays:SPECtrum:SWITching:EPSK
<Mode>,<Start>,<Samples>{,<Start>,<Samples>}
Definition of Subarrays

<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
ALL |	Return all measurement values	ALL	–	
ARIThmetical |	Return arithm. mean value in every range			
MINimum |	Return minimum value in every range			
MAXimum,	Return maximum value in every range			
<Start>	Description of parameters	Def. value	Def. unit	Unit ring
–1.8 MHz to 1.8 MHz,	Start frequency in current range	–1.8	MHz	
<Samples>	Description of parameters	Def. value	Def. unit	Unit ring
1 to 9	Number of samples in current range	9	–	

Description of command	FW vers.
This command configures the `READ:SUBarrays..`, `FETCh:SUBarrays..`, and `SAMPle:SUBarrays:SPECtrum:SWITching...` commands. It restricts the measurement to up to 32 subranges where either all measurement results (the number of which is given by the second numerical parameter) or a single statistical value is returned. The subranges are defined by the start frequency and the number of test points which are located at fixed frequencies. The subranges may overlap but must be within the total range of the *spectrum due to switching* measurement. Test points outside this range are not measured (result *NAN)* and do not enter into the ARIThmetical, MINimum and MAXimum values. By default, only one range corresponding to the total measurement range is used and all measurement values are returned.	V2.80

Measured Values

The commands of the following subsystems determine and output the results of the signal spectrum measurement. They correspond to the graphical menu *Spectrum* with its various display elements.

Subsystem SPECtrum:SWITching...

The subsystem *SPECtrum:SWITching...* measures and returns the frequency spectum (due to switching) and compares it with tolerance values. The subsystem corresponds to the graphical measurement menu *Spectrum.*

READ[:SCALar]:SPECtrum:SWITching:GMSK? Scalar Results
READ[:SCALar]:SPECtrum:SWITching:EPSK? Start single shot measurement and return results
FETCh[:SCALar]:SPECtrum:SWITching:GMSK?
FETCh[:SCALar]:SPECtrum:SWITching:EPSK? Read measurement results (unsynchronized)
SAMPle[:SCALar]:SPECtrum:SWITching:GMSK?
SAMPle[:SCALar]:SPECtrum:SWITching:EPSK? Read measurement results (synchronized)

Return	Value range	Def. value	Def. unit	Unit ring
Reference Power,	–100.0 dBm to +20.0 dBm	NAN	dBm	
Matching	INV | MATC | NMAT | NTSC | OUT | NTR | UFLW | OFLW	INV	–	

Description of command	FW vers.
These commands are always queries.	V2.80

These commands are always queries.

- `READ` starts a single shot measurement and returns the results.
- `FETCh` outputs the results without taking care of the measurement state.
- `SAMPle` waits until the results are valid for the first time (depending on the chosen statistic count) and then outputs the results.

For more details refer to the description of measurement control in chapter 5 of the CMU200 operating manual.

The reference power is the absolute carrier power measured as specified in the GSM standard. The following messages may be output for the value *Matching*:

MATC	*matching*
NMAT	*not matching*
INV	*invalid*
NTSC	*no training sequence code*
OUT	*out of range*
NTRG	*not triggered*
UFLW	*underflow*
OFLW	*overflow*

READ:ARRay:SPECtrum:SWITching:GMSK? Spectrum Results
READ:ARRay:SPECtrum:SWITching:EPSK? Start single shot measurement and return results
FETCh:ARRay:SPECtrum:SWITching:GMSK?
FETCh:ARRay:SPECtrum:SWITching:EPSK? Read measurement results (unsynchronized)
SAMPle:ARRay:SPECtrum:SWITching:GMSK?
SAMPle:ARRay:SPECtrum:SWITching:EPSK? Read results (synchronized)

Return	Description of parameters	Def. value	Def. unit	Unit ring
–100.0 dB to + 20.0 dB,	Power at measurement point 1,	NAN	dBm	
...,	...,	...	...	
–100.0 dB to + 20.0 dB	Power at measurement point 9	NAN	dBm	

Description of command	FW vers.
These commands are always queries. They return the off-carrier power due to switching at all measurement points.	V2.80

READ:SUBarrays:SPECtrum:SWITching:GMSK? Subarray Results
READ:SUBarrays:SPECtrum:SWITching:EPSK? Start measurement and return results *RUN*
FETCh:SUBarrays:SPECtrum:SWITching:GMSK?
FETCh:SUBarrays:SPECtrum:SWITching:EPSK? Read meas. results (unsynchronized) *RUN*
SAMPle:SUBarrays:SPECtrum:SWITching:GMSK?
SAMPle:SUBarrays:SPECtrum:SWITching:EPSK? Read results (synchronized) *RUN*

Ret. values per subrange	Description of parameters	Def. value	Def. unit	Unit ring
–100.0 dB to + 100.0 dB,	Power at measurement point 1,	NAN	dB	
...,	...,	...	...	
–100.0 dB to + 100.0 dB	Power at measurement point 9	NAN	dB	

Description of command	FW vers.
These commands are always queries. They output the off-carrier power due to switching in the subranges defined by means of the `CONFigure:SUBarrays:SPECtrum:SWITching:GMSK|EPSK` command. In the default setting of the configuration command the `READ:SUBarrays...`, `FETCh:SUBarrays...`, and `SAMPle:SUBarrays...` command group is equivalent to the `READ:ARRay...`, `FETCh:ARRay...`, and `SAMPle:ARRay...` command group described above. The `CONFigure:SUBarrays:SPECtrum:SWITching:GMSK|EPSK` command defines a maximum of 32 subranges. If one of the statistical modes `(ARIThmetical, MINimum, MAXimum)` is set, only one value is returned per subrange.	V2.80

GSM BTS Tests (Signalling)

In the *Signalling* mode, the CMU is able to generate BCCH and TCH signals and to set up a call to the base station. A broad range of signalling parameters can be configured and measurements may be performed with a call connection established.

Group Configuration

The remote-control commands in this section are used to configure the measurements in the menu group *GSM400/900/1800/1900-BS Signalling* globally. They correspond to the settings in the popup menu of the softkey *Group Config.* located to the left of the headline of each main menu.

Subsystem EPOWer (Expected Input Power)

The subsystem *EPOWer* determines the expected input power for the currently used input. It corresponds to the tab *Input Level* in the popup menu *Group Configuration*.

[SENSe:]EPOWer:MODE <*Mode*>				Input Level – Mode
<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
MANual | **AUTomatic**	Manual setting Automatic setting corresponding to average power of signal applied	AUT	–	
Description of command			Sig. State	FW vers.
This command defines the mode for setting the maximum input level.			all	V2.80

[SENSe:]EPOWer:VALue <*Level*>				Max. Level
<Level>	Description of parameters	Def. value	Def. unit	Unit ring
0 dBm to +53 dBm	Maximum input level for RF 1	30.0	dBm	–
–14 dBm to 39 dBm	Maximum input level for RF 2	30.0	dBm	
–37 dBm to 0 dBm	Maximum input level for RF 4 IN	0.0	dBm	
Description of command			Sig. State	FW vers.
This command defines the maximum input level. The permissible value range depends on the RF input used and the external attenuation set (see `[SENSe:]CORRection:LOSS:INPut<nr> [:MAGNitude]` command).			all	V2.80

[SENSe:]EPOWer:ATTenuation <*Mode*>				Attenuation
<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
NORMal | **LNOise |** **LDIStortion**	Normal (input level is maintained) Low noise, CMU at full-range level Low distortion (high transmission reserve)	LNOise	–	–
Description of command			Sig. State	FW vers.
This command defines the attenuation or gain factor for the RF input signal.			all	V2.80

DEFault:EPOWer <Enable>				Default Settings
<Enable>	Description of parameters	Def. value	Def. unit	Unit ring
ON | **OFF**	All parameters are set to their default values Some or all parameters differ from the default values	ON	–	
Description of command			Sig. State	FW vers.
If used with *ON*, this command sets all the parameters of the subsystem to their default values. (*OFF* has no effect). In the query format, the command returns *ON* if all the parameters of the subsystem correspond to their default values, otherwise it returns *OFF*.			all	V2.80

Subsystem TRIGger (Trigger Mode)

The subsystem *TRIGger* defines the trigger mode. It corresponds to the tab *Trigger* in the popup menu *Group Configuration*.

TRIGger[:SEQuence]:SOURce <*Source*>				Source
<Source>	Description of parameters	Def. value	Def. unit	Unit ring
SIGNalling **FRUN |** **RFPower |** **IFPower**	The measurement is triggered by the signalling unit The measurement is triggered by the TDMA timing (free-run mode) of the analyzed signal Wide-band power trigger Narrow-band trigger	SIGN	–	–
Description of command			Sig. State	FW vers.
This command defines the trigger condition. The setting *FRUN* assumes burst signals with incorporated training sequence.			all	V2.80

TRIGger[:SEQuence]:THReshold <*Threshold*>				Level
<Threshold>	Description of parameters	Def. value	Def. unit	Unit ring
LOW | **MEDium |** **HIGH**	Low trigger threshold (reference level –26 dB) Medium trigger threshold (ref. level –16 dB) High trigger threshold (reference level –6 dB)	LOW	–	–
Description of command			Sig. State	FW vers.
This command sets the level at which the trigger signal (cf. `TRIGger[:SEQuence]:SOURce`) triggers the measurement.			all	V2.80

DEFault:TRIGger[:SEQuence] <Enable>				Default Settings
<Enable>	Description of parameters	Def. value	Def. unit	Unit ring
ON | **OFF**	All parameters are set to their default values Some or all parameters differ from the default values	ON	–	
Description of command			Sig. State	FW vers.
If used with *ON*, this command sets all the parameters of the subsystem to their default values (*OFF* has no effect). In the query format, the command returns *ON* if all the parameters of the subsystem correspond to their default values, otherwise it returns *OFF*.			all	V2.80

Connection Control

The remote-control commands presented in this section control the signalling (call setup and cleardown, services, signalling parameters), determine the inputs and outputs as well as the reference frequency. They correspond to the settings in the popup menu of the softkey *Connect. Control* located to the right of the headline of each main menu (see chapter 4).

Signalling – Subsystem SIGNalling (Call Setup and Cleardown)

The subsystem *SIGNalling* controls the call setup and cleardown from the CMU to the BTS and determines the signalling parameters. Together with the subsystem *WPOWer* (see below) it corresponds to the four tabs *Signalling* (for four different signalling states, see command `PROCedure:SIGNalling:ACTion`) in the popup menu *Connect. Control*.

PROCedure:SIGNalling:ACTion *<Action>*				Signalling Control
<Action>	Description of parameters	Def. value	Def. unit	Unit ring
SRUN |	Start synchronization	–	–	–
SSTP |	Stop synchronization			
CCH |	Switch to control channel			
TCH |	Switch to traffic channel			
LUP |	Location update			
SLUP |	Stop location update			
RLUP |	Retry location update			
MOC |	MOC			
SMOC |	Stop MOC/MTC			
RMOC |	Retry MOC			
SCR |	Stop call release			
CREL	Call release			
Description of command			Sig. State	FW vers.
This command has no query form and no default value. It changes between the different signalling states of the CMU.			See below	V2.80

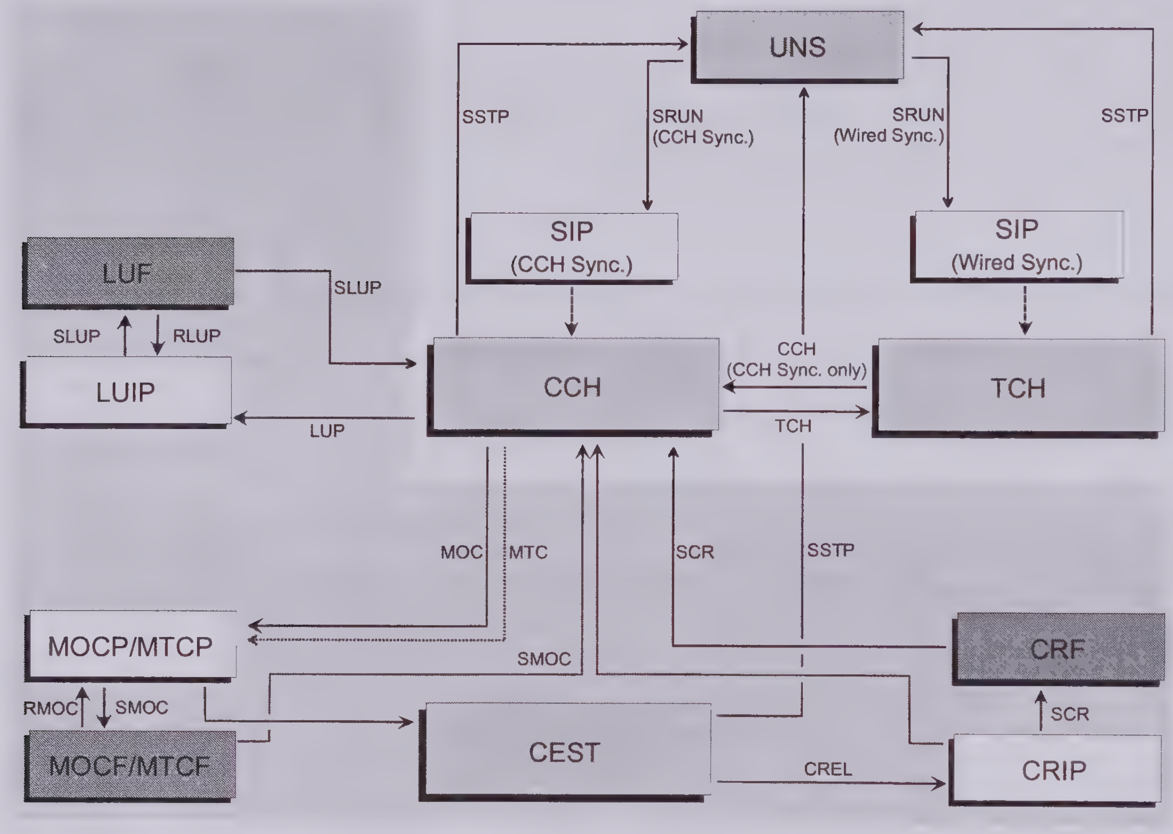
UNS
SSTP
SRUN (CCH Sync.)
SRUN (Wired Sync.)
SSTP
SIP (CCH Sync.)
SIP (Wired Sync.)
LUF
SLUP
SLUP
RLUP
LUIP
LUP
CCH
CCH (CCH Sync. only)
TCH
TCH
MOC
MTC
SCR
SSTP
MOCP/MTCP
SMOC
CRF
RMOC
SMOC
SCR
MOCF/MTCF
CEST
CREL
CRIP

Fig. 6-1 Signalling states of the CMU

Actions:	See description of command `PROCedure:SIGNalling:ACTion` above.
Signalling states:	See description of command `[SENSe:]SIGNalling:STATe?` below.

Note: *The CEST state and all other states in the shaded area in Fig. 6-1 are available with option CMU-K39, MOC/MTC only.*

[SENSe:]SIGNalling:STATe? Signalling State

Return	Description of parameters	Def. value	Def. unit	Unit ring
UNS |	Unsynchronized	UNS	–	–
SIP |	synchronization in progress			
CCH |	synchronized, CCH Test			
TCH |	synchronized, TCH Test			
LUIP |	Location update in progress			
LUF	Location update failed			
CEST |	Call established			
CREL |	Call release			
CRIP |	Call release in progress			
CRF |	Call release failed			
MOCP	MOC in progress			
MOCF	MOC failed			
MTCP	MTC in progress			
MTCF	MTC failed			

Description of command	Sig. State	FW vers.
This command is always a query. It reads out the current signalling state.	all	V2.80

CONFigure:SIGNalling:SMODe ***<Mode>***				Sync. Mode
<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
NUBCch | **NUETrg**	No Location Update CCH (fix) Wired CCHc. (External Trigger)	NUBCch	–	–
Description of command			Sig. State	FW vers.
This command determines the synchronization mode. Depending on the synchronization mode, either the control channel number or the training sequence code must be defined for the synchronization signal: see commands `CONFigure:SIGNalling:CCH:CHANnel` and			UNS Q: all	V2.80

Subsystem BSSignal (Signal of Base Station)

The subsystem *BSSignal* configures the control and traffic channels for the signals sent by the base station under test. It corresponds to the tab *BS Signal* in the popup menu *Connect. Control*.

CONFigure:BSSignal:CCH:CHANnel ***<ChannelNumber >***				CCH RF Chan.
<ChannelNumber>	Description of parameters	Def. value	Def. unit	Unit ring
259 to 340	Number of control channel, GSM400	261		
0 to 124 | 955 to 1023	Number of control channel, GSM900	32		
512 to 885	Number of control channel, GSM1800	606		
512 to 810	Number of control channel, GSM1900	586		
Description of command			Sig. State	FW vers.
This command defines the control channel number (and thus the frequency) of the signal which the base station transmits for synchronization. The command is available only if the synchronization mode is set to *No Location Update BCCH (fix)*, see command `CONFigure:SIGNalling:SMODe`.			UNS Q: all	V2.80

CONFigure:BSSignal:TCH:CHANnel ***<ChannelNumber >***				TCH RF Chan.
<ChannelNumber>	Description of parameters	Def. value	Def. unit	Unit ring
259 to 340	Number of traffic channel, GSM400	291		
0 to 124 | 955 to 1023	Number of traffic channel, GSM900	32		
512 to 885	Number of traffic channel, GSM1800	696		
512 to 810	Number of traffic channel, GSM1900	661		
Description of command			Sig. State	FW vers.
This command determines the traffic channel number (and thus the frequency) for the BTS traffic channel signal.			all Q: all	V2.80

[SENSe:]BSSignal:TCH:CHANnel? TCH RF Chan.

Returned value	Description of parameters	Def. value	Def. unit	Unit ring
259 to 340	Number of traffic channel, GSM400	NAN		
0 to 124 | 955 to 1023	Number of traffic channel, GSM900	NAN		
512 to 885	Number of traffic channel, GSM1800	NAN		
512 to 810	Number of traffic channel, GSM1900	NAN		

Description of command	Sig. State	FW vers.
This command is always a query. In the *Call Established* signalling state, it queries the traffic channel number (and thus the frequency) for the BTS traffic channel signal.	CEST	V2.80

CONFigure:BSSignal:TCH:TIMeslot <*Timeslot*> TCH Timeslot

<Timeslot>	Description of parameters	Def. value	Def. unit	Unit ring
0 to 7	Timeslot of traffic channel	3	–	–

Description of command	Sig. State	FW vers.
This command determines the traffic channel timeslot for the BTS traffic channel signal.	all Q: all	V2.80

[SENSe:]BSSignal:TCH:TIMeslot? TCH Timeslot

Returned value	Description of parameters	Def. value	Def. unit	Unit ring
0 to 7	Timeslot of traffic channel	3	–	–

Description of command	Sig. State	FW vers.
This command is always a query. In the *Call Established* signalling state, it queries the traffic channel timeslot for the BTS traffic channel signal.	CEST	V2.80

CONFigure:BSSignal:TCH:TSEQuence <*Sequence*> Training Sequence

<Sequence>	Description of parameters	Def. value	Def. unit	Unit ring
GSM0 to GSM7	Training sequence of traffic channel	GSM0	–	–

Description of command	Sig. State	FW vers.
This command determines the training sequence in the BTS traffic channel signal. It is avaliable for wired synchronization only, see command `CONFigure:SIGNalling:SMODe NUETrg`.	all Q: all	V2.80

CONFigure:BSSignal:TCH:CHTYpe <*Type*> Channel Type

<Type>	Description of parameters	Def. value	Def. unit	Unit ring
FRATe |	Standard traffic channel full-rate coding	TCHFR	–	–
EFRate |	TCH enhanced full rate			
E432 |	TCH Edge 432			
HRATe |	TCH half-rate coding			
FD144 |	Full-rate data 14400 Baud			
FD96 |	Full-rate data 9600 Baud			
FD48 |	Full-rate data 4800 Baud			
HD48 |	Half-rate data 4800 Baud			
HD24	Half-rate data 2400 Baud			

Description of command	Sig. State	FW vers.
This command determines the speech coding and transmission rate in the traffic channel.	all	V2.80

DEFault:BSSignal *<Enable>* Default Settings

<Enable>	Description of parameters	Def. value	Def. unit	Unit ring
ON | **OFF**	All parameters are set to their default values Some or all parameters differ from the default values	ON	–	

Description of command	Sig. State	FW vers.
If used with *ON*, this command sets all the parameters of the subsystem to their default values (*OFF* has no effect). In the query format, the command returns *ON* if all the parameters of the subsystem correspond to their default values, otherwise it returns *OFF*.	all	V2.80

Signalling – Test Object INFO

The subsystem *INFO* contains the commands for the frame timing and the network data. It corresponds to the *Signalling Info* table in the *Signalling (synchronized)* tab.

[SENSe:]INFO:FTIMing:MULTiframe? *<Frame>* Multiframe

<Frame>	Description of parameters	Def. value	Def. unit	Unit ring
0 to 25	Multiframe	NAN	–	–

Description of command	Sig. State	FW vers.
This command is always a query. It reads the multiframe currently transmitted by the base station.	CCH[4]	V2.80

[SENSe:]INFO:FTIMing:SUPerframe? *<Frame >* Superframe

< Frame >	Description of parameters	Def. value	Def. unit	Unit ring
0 to 2047	Superframe	NAN	–	–

Description of command	Sig. State	FW vers.
This command is always a query. It reads the superframe currently transmitted by the base station.	CCH[4]	V2.80

[SENSe:]INFO:NWData:MCC? *<Code>* Network Data - MCC

<Code>	Description of parameters	Def. value	Def. unit	Unit ring
0 to 999	Mobile Country Code	NAN	–	–

Description of command	Sig. State	FW vers.
This command is always a query. It reads the Mobile Country Code.	all	V2.80

---

[4] The frame counters are active in signalling state *CCH* and with CCHchronization mode *No Location Update BCCH (fix)* only; see command `CONFigure:SIGNalling:SMODe NUBCch`.

[SENSe:]INFO:NWData:MNC? *<Code>*				Network Data - MNC
<Code>	Description of parameters	Def. value	Def. unit	Unit ring
0 to 99	Mobile Network Code	NAN	–	–
Description of command			Sig. State	FW vers.
This command is always a query. It reads the Mobile Network Code.			all	V2.80

[SENSe:]INFO:NWData:BSIC? *<Id>*				Network Data – BSIC
<Id>	Description of parameters	Def. value	Def. unit	Unit ring
0 to 63	Base Station Identification Code	NAN	–	–
Description of command			Sig. State	FW vers.
This command is always a query. It reads the Base Station Identification Code.			all	V2.80

[SENSe:]INFO:NWData:LOCation:AREA? *<Area>*				Network Data – Location Area
<Area>	Description of parameters	Def. Value	Def. unit	Unit ring
0 to 999	Location Area Code	NAN	–	–
Description of command			Sig. State	FW vers.
This command is always a query. It reads the Location Area Code.			all	V2.80

[SENSe:]INFO:NWData:LOCation:UPDate? *<State>*				Location Update
<State>	Description of parameters	Def. value	Def. unit	Unit ring
PERFormed | NPERformed	Update flag of the location area	NPER	–	–
Description of command			Sig. State	FW vers.
This command is always a query. It reads the update flag of the location area.			all	V2.80

[SENSe:]INFO:SACChinfo:REQuested:POWer? *<Power>*				Requested Power
<Power>	Description of parameters	Def. value	Def. unit	Unit ring
0 to 31	Transmission Power Level requested by the base station	NAN	–	
Description of command			Sig. State	FW vers.
This command is always a query. It reads the transmission power level as requested by the base station.			all	V2.80

[SENSe:]INFO:SACChinfo:REQuested:TIMing? *<bit>*				Requested Timing
<bit>	Description of parameters	Def. value	Def. unit	Unit ring
0 bit to 63 bit	Timing requested by the base station	NAN	bit	
Description of command			Sig. State	FW vers.
This command is always a query. It reads the timing as requested by the base station.			all	V2.80

Signalling – Subsystem MSSignal (Signal Parameters)

The subsystem *MSSignal* controls the (re)transmission parameters and the signals of the CMU. It corresponds to the tabs *MS Signal* (for different signalling states, see command `PROCedure:SIGNalling:ACTion`) in the popup menu *Connect. Control*.

CONFigure:MSSignal:BITStream <*Mode*> bit Stream

<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
LOOP |	Loop-back with delay	ECHO	–	–
ECHO |	Loop-back with minimum delay			
PR9 |	Pseudo random sequences			
PR11 |				
PR15 |				
PR16 |				
LBBB	Loop burst by burst			
HAND	bit pattern generated on the speech codec			

Description of command	Sig. State	FW vers.
This command defines the data transmitted in the traffic channel. In a *Receiver Quality* (BER) measurement one of the pseudo random sequences must be used.	all	V2.80

CONFigure:MSSignal:TXTiming <*Delay*> Transmit Timing

<Delay>	Description of parameters	Def. value	Def. unit	Unit ring
–64/4 bit to +64/4 bit	Transmit timing delay in ¼ bit units	0	¼ bit	–

Description of command	Sig. State	FW vers.
This command sets the delay time between the start of the timeslot and the actual transmission of the burst.	all	V2.80

CONFigure:MSSignal:LEVel:UTIMeslot <*Level*> RF Level

<Level>	Description of parameters	Def. value	Def. unit	Unit ring
–200 dBm to –100 dBm	Level in the used timeslot	–80	dBm	–

Description of command	Sig. State	FW vers.
This command determines the RF level in the used timeslot of the CMU traffic and control channel signal.	all	V2.80

CONFigure:MSSignal:LEVel:UNTimeslot <*Level*> RF Level

<Level>	Description of parameters	Def. value	Def. unit	Unit ring
–200 dB to –100 dB	Level in the unused timeslot	–20	dB	–

Description of command	Sig. State	FW vers.
This command determines the RF level in the unused timeslots relative to the used timeslot level of the CMU traffic and control channel signal.	all	V2.80

DEFault:MSSignal *<Enable>* Default Settings

<Enable>	Description of parameters	Def. value	Def. unit	Unit ring
ON | **OFF**	All parameters are set to their default values Some or all parameters differ from the default values	ON	–	

Description of command	Sig. State	FW vers.
If used with *ON*, this command sets all the parameters of the subsystem to their default values (*OFF* has no effect). In the query format, the command returns *ON* if all the parameters of the subsystem correspond to their default values, otherwise it returns *OFF*.	all	V2.80

Subsystem NETWork (with Option CMU-K39 only)

The subsystem *NETWork* determines the parameters of the radio network and the existing radio link. The subsystem corresponds to the *Network* tab in the *Connect. Control* menu.

DEFault:NETWork <*Enable*>				Network – Default Settings
<Enable>	Description of parameters	Def. value	Def. unit	Unit ring
ON | **OFF**	All parameters are set to their default values Some or all parameters differ from the default values	ON	–	
Description of command			Sig. State	FW vers.
If used with *ON*, this command sets all the parameters of the subsystem to their default values. (*OFF* has no effect). In the query format, the command returns *ON* if all the parameters of the subsystem correspond to their default values, otherwise it returns *OFF*.			UNS, CCH Q.: all	V2.80

Subsystem NETWork[:MS] (Mobile settings)

The subsystem *NETWork[:MS]* defines the mobile parameters. The subsystem corresponds to the table field *Mobile Settings* in the popup menu *Network*.

CONFigure:NETWork[:MS]:AUTohookoff <*Time*>				Auto Hook Off
<Time>	Description of parameters	Def. value	Def. unit	Unit ring
1.0 s to 100.0 s	Alerting time at the CMU	1.0	s	–
Description of command			Sig. State	FW vers.
This command sets the time until the CMU accepts a call from the mobile station (equivalent to the time after which a mobile is picked up).			UNS, CCH Q.: all	V2.80

Subsystem NETWork:SUBScriberid

The subsystem *NETWork:SUBScriberid* gives information on the identity of the mobile. The subsystem corresponds to the table field *Network Subscriber Identity* in the *Network* tab.

CONFigure:NETWork:SUBScriberid:SCPin <*PIN*>				PIN of the SIM card
<PIN>	Description of parameters	Def. value	Def. unit	Unit ring
0 to 9999	PIN of SIM card	0	–	–
Description of command			Sig. State	FW vers.
This command determines the PIN of the SIM card.			UNS, CCH Q.: all	V2.80

CONFigure:NETWork:SUBScriberid:IMEI *<IMEI>* International Mobile Station Equipment Identity

<IMEI>	Description of parameters	Def. value	Def. unit	Unit ring
Format: **xxxxxx.xx.xxxxxx.x**	15-digit IMEI. A point may be inserted after the 6th, 8th and 14th digit (but then at all three positions).	123456.78.901234.5	–	–

Description of command	Sig. State	FW vers.
This command determines the international mobile station equipment identity (IMEI).	UNS, CCH Q.: all	V2.80

CONFigure:NETWork:SUBScriberid:IMSI *<IMSI>* International Mobile Subscriber Identity *(IMSI)*

<IMSI>	Description of parameters	Def. value	Def. unit	Unit ring
Format: **GSM400/900/1800:** **xxx.xx.xxxxxxxxxx**	In GSM400, GSM900, GSM1800 and UIC networks, the IMSI should consist of 6 to 15 digits. A point may be inserted after the 3rd and 5th digit (but then at both positions).	123.45.6789012345	–	–
GSM1900: **xxx.xxx.xxxxxxxxx**	With GSM1900 the minimum length is 7 digits and points may be inserted after the 3rd and 6th digit.			

Description of command	Sig. State	FW vers.
This command determines the international mobile subscriber identity *(IMSI)*.	UNS, CCH Q.: all	V2.80

CONFigure:NETWork:SUBScriberid:DNUMber *<Number>* Dialled Number

<Number>	Description of parameters	Def. value	Def. unit	Unit ring
max. 20 digits	Dialled number	1234567890123456789	–	–

Description of command	Sig. State	FW vers.
This command determines the dialled number.	UNS, CCH Q.: all	V2.80

Subsystem NETWork:MREPort (Measurement Report)

The subsystem *NETWork:MREPort* determines parameters for the received signal. The subsystem corresponds to the table field *Measurement Report* in the *Network* tab.

CONFigure:NETWork:MREPort:MODE *<Mode>* Measurement Report – Mode

<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
MANual |	CMU transmits preset values for RX Level and RX Quality to the base station	MANUal	–	–
RXQualauto |	CMU transmits a preset RX Level plus the corresponding RX Quality from the table *RX Quality at RX Level.*			
AUTomatic	CMU transmits the measured RX Level plus the corresponding RX Quality from the table *RX Quality at RX Level.*			

Description of command	Sig. State	FW vers.
This command selects the mode of configuring the measurement report. The preset values for RX Level and RX Quality are defined by means of the commands `CONFigure:NETWork:MREPort:MANual:RXLevel` and `...MANual:RXQual`; see below. The table *RX Quality at RX Level* is defined via `CONFigure:NETWork:MREPort:AUTO:RXLQ`.	UNS, CCH Q.: all	V2.80

CONFigure:NETWork:MREPort:MANual:RXLevel *<Level>* RX Level (Manual)

<Level>	Description of parameters	Def. value	Def. unit	Unit ring
0 to 63	RX Level for manual measurement report	20	–	–

Description of command	Sig. State	FW vers.
This command determines the RX Level which is transmitted to the base station in `MANual` mode.	UNS, CCH Q.: all	V2.80

CONFigure:NETWork:MREPort:MANUal:RXQuality *<Quality>* RX Quality (Manual)

<Quality>	Description of parameters	Def. value	Def. unit	Unit ring
0 to 7	RX Quality for manual measurement report	0	–	–

Description of command	Sig. State	FW vers.
This command determines the RX Quality which is transmitted to the base station in `MANual` mode.	UNS, CCH Q.: all	V2.80

CONFigure:NETWork:MREPort:AUTO:RXLevel *<Level>* RX Level (Auto RX Qual)

<Level>	Description of parameters	Def. value	Def. unit	Unit ring
0 to 63	RX Level for auto RX Quality measurement report	63	–	–

Description of command	Sig. State	FW vers.
This command determines the RX Level which is transmitted to the base station in `RXQualauto` mode. The corresponding RX Quality value is selected from the *RX Quality at RX Level* table defined via `CONFigure:NETWork:MREPort:AUTO:RXLQ`.	UNS, CCH Q.: all	V2.80

CONFigure:NETWork:MREPort:AUTO:RXOFfset <*Offset*> Offset (Auto RX Level and RX Qual)				
<Offset>	Description of parameters	Def. value	Def. unit	Unit ring
-200 dB to 100 dB	Offset added to the measured RX Level	–50	dB	–
Description of command			Sig. State	FW vers.
This command determines the Offset which is added to the measured RX Level in `AUTomatic` mode. The result is transmitted to the base station and is also used to select the corresponding RX Quality value from the *RX Quality at RX Level* table defined via `CONFigure:NETWork:MREPort: AUTO:RXLQ`.			UNS, CCH Q.: all	V2.80

CONFigure:NETWork:MREPort:AUTO:RXLQ **<*RxLevel_1*>, ..., <*RxLevel_7*>**				RX Quality at RX Level
<RxLevel_n>	Description of parameters	Def. value	Def. unit	Unit ring
1 to 63,	RX Level corresponding to 0.2% < RX Quality ≤ 0.4%	11	–	–
1 to 63,	RX Level corresponding to 0.4% < RX Quality ≤ 0.8%			
1 to 63,	RX Level corresponding to 0.8% < RX Quality ≤ 1.6%			
1 to 63,	RX Level corresponding to 1.6% < RX Quality ≤ 3.2%			
1 to 63,	RX Level corresponding to 3.2% < RX Quality ≤ 6.4%			
1 to 63,	RX Level corresponding to 6.4% < RX Quality ≤ 12.8%			
1 to 63	RX Level corresponding to RX Quality > 12.8%			
Description of command			Sig. State	FW vers.
This command defines the *RX Quality at RX Level* table values which is used in `RXQUalauto` and `AUTomatic` mode.			UNS, CCH Q.: all	V2.80

Subsystem for RF Input and Output Connectors

The following commands configure the RF input and output connectors. The commands correspond to the tab *RF* ⊕ in the popup menu *Connect. Control.*

INPut[:STATe] <*State*>				RF Input
<State>	Description of parameters	Def. value	Def. unit	Unit ring
RF1	Connector RF1 used as input	RF2	–	–
RF2	Connector RF2 used as input			
RF4	Connector RF4 IN used as input			
Description of command			Sig. State	FW vers.
This command determines the connector to be used for incoming RF signals. The bidirectional connectors RF 1 and RF 2 can be used both as input and output connectors in the very same measurement (see `OUTPut[:STATe]`). When changing to a different subsystem (other band or changing from Signalling to Non-Signalling), the connector settings of the new subsystem are activated.			all	V2.80

OUTPut[:STATe] *<State>* RF Output

<State>	Description of parameters	Def. value	Def. unit	Unit ring
RF1 **RF2** **RF3**	Connector RF1 used as output Connector RF2 used as output Connector RF3 OUT used as output	RF2	–	–

Description of command	Sig. State	FW vers.
This command determines the connector to be used for outgoing RF signals. The bidirectional connectors RF 1 and RF 2 can be used both as input and output connectors in the very same measurement. When changing to a different subsystem (other band or changing from Signalling to Non-Signalling), the connector settings of the new subsystem are activated.	all	V2.80

[SENSe:]CORRection:LOSS:INPut<nr>[:MAGNitude] *<Attenuation >*
SOURce:CORRection:LOSS:INPut<nr>[:MAGNitude] *<Attenuation >* Ext. Att. Input

<Attenuation>	Description of parameters	Def. value	Def. unit	Unit ring
–50 dB to +50 dB	Value for external attenuation at Input<nr>, where <nr> = 1,2,4	0	dB	Ratio

Description of command	Sig. State	FW vers.
This command assigns an external attenuation value to one of the inputs defined before (see command `INPut:STATe`).	all	V2.80

[SENSe:]CORRection:LOSS:OUTPut<nr>[:MAGNitude] *<Attenuation>*
SOURce:CORRection:LOSS:OUTPut<nr>[:MAGNitude] *<Attenuation>* Ext. Att. Output

<Attenuation>	Description of parameters	Def. value	Def. unit	Unit ring
–50 dB to +50 dB	Value for external attenuation at Output<nr>, where <nr> = 1,2,3	0	dB	Ratio

Description of command	Sig. State	FW vers.
This command assigns an external attenuation value to one of the outputs defined before (see command `OUTPut:STATe`).	all	V2.80

Subsystem DM:CLOCk (Clock Frequency)

The subsystem *DM:CLOCk* sets the network-specific clock frequency. The subsystem corresponds to the *REF OUT 2* softkey in the *Synch.* tab of the popup menu *Connect. Control.*

SOURce:DM:CLOCk:STATe *<Mode>* REF OUT 2

<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
ON | OFF	Switching the clock signal on/off	OFF	–	–

Description of command	Sig. State	FW vers.
This command switches the network-specific clock frequency at output *REF OUT 2* on or off.	all	V2.80

SOURce:DM:CLOCk:FREQuency *<Frequency>* REF OUT 2

<Frequency>	Description of parameters	Def. value	Def. unit	Unit ring
1.2190 MHz to 39.000 MHz	Input value for reference frequency	13.000	MHz	
Description of command			Sig. State	FW vers.
This command defines the clock frequency applied to output *REF OUT 2*. The frequency entered is rounded to one of the following discrete values: 39.000 MHz, 19.500 MHz, 13.000 MHz, 9.750 MHz, 7.800 MHz, 6.500 MHz, 5.571 MHz, 4.875 MHz, 4.333 MHz, 3.900 MHz, 3.545 MHz, 3.250 MHz, 3.000 MHz, 2.786 MHz, 2.600 MHz, 2.438 MHz, 2.294 MHz, 2.166 MHz, 2.053 MHz, 1.950 MHz, 1.857 MHz, 1.773 MHz, 1.696 MHz, 1.625 MHz, 1.560 MHz, 1.500 MHz, 1.444 MHz, 1.393 MHz, 1.349 MHz, 1.300 MHz, 1.258 MHz, 1.219 MHz			all	V2.80

Subsystem EXTernal[:TRIGger] (External Trigger Input)

The subsystem *EXTernal[:TRIGger]* configures the *External Trigger* synchronization mode (see command `CONFigure:SIGNalling:SMODe NUEtrg` on page 6.79; the *EXTernal[:TRIGger]* commands are not effective in the other synchronization modes). The subsystem corresponds to the *External Trigger Input* panel of the *Synch.* tab in the popup menu *Connect. Control*.

CONFigure:EXTernal[:TRIGger][:INPut]:POLarity *<Polarity>* Polarity

<Polarity>	Description of parameters	Def. value	Def. unit	Unit ring
RISing | FALLing	Synchronization triggered by rising or falling edge of external trigger signal.	RISing	–	–
Description of command			Sig. State	FW vers.
This command defines the polarity of the external trigger.			UNS Q: all	V2.80

CONFigure:EXTernal[:TRIGger][:INPut]:SOFFset *<Offset>* Slot Offset

<Offset>	Description of parameters	Def. value	Def. unit	Unit ring
0 to 256	Delay time for TCH signal, no. of timeslots	0	Slots	–
Description of command			Sig. State	FW vers.
This command defines a number of timeslots by which the TX TCH signal of the CMU is shifted relative to the external trigger signal. This delay time can be further modified by the `CONFigure:EXTernal[:TRIGger][:INPut]:BITDelay` command; see below.			UNS Q: all	V2.80

CONFigure:EXTernal[:TRIGger][:INPut]:BITDelay *<Offset>* ¼ bit Delay

<Offset>	Description of parameters	Def. value	Def. unit	Unit ring
0 to 624	Delay time, ¼ bit periods	0	¼ bit	–
Description of command			Sig. State	FW vers.
This command defines a delay time in ¼ bit units by which the TX TCH signal of the CMU is shifted relative to the external trigger signal. This delay time is added to the slot offset defined by the `CONFigure:EXTernal[:TRIGger][:INPut]: SOFFset` command; see above.			UNS Q: all	V2.80

Test Object WPOWer (Wide Band Power)

The subsystem *WPOWer* measures the power of the signal received from the base transceiver station using a wide band filter. It corresponds to the softkey *Power* of the tab *Signalling* in the menu group *Connect. Control*.

INITiate:WPOWer	Start new measurement		*RUN*
ABORt:WPOWer	Abort measurement and switch off		*OFF*
STOP:WPOWer	Stop measurement		*STOP*
CONTinue:WPOWer	Next measurement step (only *counting mode*)		*RUN*
Description of command		Sig. State	FW vers.
These commands do not exist as queries. They start or stop the measurement, setting it to the status given in the top right column.		all	V2.80

CONFigure:WPOWer:EREPorting <*Mode*>				Event Reporting
<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
SRQ | **SOPC |** **SRSQ |** **OFF**	Service request Single operation complete SRQ and SOPC No reporting	OFF	–	
Description of command			Sig. State	FW vers.
This command defines the events generated when the measurement is terminated or stopped *(event reporting,* see chapter 5).			all	V2.80

FETCh:WPOWer:STATus?				Measurement Status
Return	Description of parameters	Def. value	Def. unit	Unit ring
OFF | **RUN |** **STOP |** **ERR |** **STEP |** **RDY,**	Measurement in the *OFF* state (`*RST` or `ABORt`) Running (after `INITiate`, `CONTinue` or `READ`) Stopped (`STOP`) *OFF* (could not be started) Stepping mode *(<stepmode>=STEP)* Stopped according to repetition mode and stop condition	OFF	–	–
1 to 10000 | **NONE**	Counter for current statistics cycle No counting mode set	NONE	–	–
Description of command			Sig. State	FW vers.
This command is always a query. It returns the status of the measurement (see chapters 3 and 5).			all	V2.80

CONFigure:WPOWer:CONTrol:REPetition ***<Repetition>,<StopCond>,<Stepmode>*** Test Cycles

<Repetition>	Description of parameters	Def. value	Def. unit	Unit ring
CONTinuous | **SINGleshot |** **1 to 10000**	Continuous measurement (until `STOP` or `ABORT`) Single shot measurement (until `Status = RDY`) Multiple measurement (*counting*, until `Status = STEP | RDY`)	SING	–	–

<StopCond>	Description of parameters	Def. value	Def. unit	Unit ring
SOERror | **NONE**	Start measurement in case of error *(stop on error)* Continue measurement even in case of error	NONE	–	–

<Stepmode>	Description of parameters	Def. value	Def. unit	Unit ring
STEP | **NONE**	Interrupt measurement after each statistics cycle Continue measurement according to its rep. mode	NONE	–	–

Description of command	Sig. State	FW vers.
This command determines the number of statistics cycles, the stop condition and the stepping mode for the measurement. **Note:** *In the case of READ commands (`READ:...`), the <Repetition> parameter has no effect; the measurement is always stopped after a single shot.*	all	V2.80

READ[:SCALar]:WPOWer? Start single shot measurement and return results
FETCh[:SCALar]:WPOWer? Read out measurement results (unsynchronized)
SAMPle[:SCALar]:WPOWer? Read out measurement results (synchronized)

Return	Description of parameters	Def. value	Def. unit	Unit ring
–100.0dBm to +53.0 dBm	Maximum burst power (not averaged)	NAN	dBm	

Description of command	Sig. State	FW vers.
These commands are always queries. They start the measurement of the maximum burst power of the signals sent by the base station *(`READ...`)* and output the result.	all	V2.80

Test Object POWer

The subsystem *POWer* measures the signal power. The subsystem corresponds to the measurement menu *Power* and the associated popup menu *Power Configuration*. Depending on the signalling state, power measurements of the control channel (state *CCH Test (CCH)*) or the traffic channel (state *TCH Test)* can be performed. The alternative keywords *CCH* or *TCH* in the command headers distinguish between these modes.

Important Note!

> *The keywords* `:GMSK` *and* `:EPSK` *in the remote control commands denote GMSK and 8PSK modulation, respectively. The* `:EPSK` *commands are available with option CMU-K41 only.*
>
> *Measurement configurations are generally possible in all signalling states. However, to* `INITiate`, `ABORt`, `STOP`, `CONTinue` *a measurement, and to obtain measurement results, the command* `PROCedure:SIGNalling:ACTion` *must be used to access either the* TCH Test *or* Call Established *mode (commands including the keyword* `:TCH`*; traffic channel tests) or the* CCH *mode (commands including the keyword* `:CCH`*; control channel tests).*
>
> `:EPSK` *measurements are available in the* TCH *test mode only.*

Control of Measurement – Subsystem Power

The subsystem *POWer* contains the commands for general control of the power measurement.

INITiate:POWer:NBURst:GMSK:CCH **INITiate:POWer:NBURst:GMSK:TCH** **INITiate:POWer:NBURst:EPSK:TCH**	Start new measurement	*RUN*
ABORt:POWer:NBURst:GMSK:CCH **ABORt:POWer:NBURst:GMSK:TCH** **ABORt:POWer:NBURst:EPSK:TCH**	Abort running measurement and switch off	*OFF*
STOP:POWer:NBURst:GMSK:CCH **STOP:POWer:NBURst:GMSK:TCH** **STOP:POWer:NBURst:EPSK:TCH**	Stop measurement after current stat. cycle	*STOP*
CONTinue:POWer:NBURst:GMSK:CCH **CONTinue:POWer:NBURst:GMSK:TCH** **CONTinue:POWer:NBURst:EPSK:TCH**	Next meas. step (only *stepping mode*)	*RUN*
Description of command	Sig. State	FW vers.
These commands do not exist as queries. They start or stop the measurement, setting it to the status indicated in the top right column.	CCH TCH	V2.80

CONFigure:POWer:NBURst:GMSK:CCH:EREPorting <*Mode*>
CONFigure:POWer:NBURst:GMSK:TCH:EREPorting <*Mode*>
CONFigure:POWer:NBURst:EPSK:TCH:EREPorting <*Mode*>

Event Reporting

<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
SRQ |	Service request	OFF	–	–
SOPC |	Single operation complete			
SRSQ |	SRQ and SOPC			
OFF	No reporting			

Description of command	Sig. State	FW vers.
This command defines the events generated when the measurement is terminated or stopped *(event reporting*, see chapter 5).	all	V2.80

FETCh:POWer:NBURst:GMSK:CCH:STATus?
FETCh:POWer:NBURst:GMSK:TCH:STATus?
FETCh:POWer:NBURst:EPSK:TCH:STATus?

Measurement Status

Return	Description of parameters	Def. value	Def. unit	Unit ring
OFF |	Measurement in the *OFF* state (`*RST` or `ABORt`)	OFF	–	–
RUN |	Running (after `INITiate`, `CONTinue` or `READ`)			
STOP |	Stopped (`STOP`)			
ERR |	*OFF* (could not be started)			
STEP |	Stepping mode *(<stepmode>=STEP)*			
RDY,	Stopped according to repetition mode and stop condition			
1 to 10000 |	Counter for current statistics cycle			
NONE,	No counting mode set	NONE	–	–
1 to 1000 |	Counter for current evaluation period within a cycle			
NONE	Statistic count set to off	NONE	–	–

Description of command	Sig. State	FW vers.
This command is always a query. It returns the status of the measurement (see chapters 3 and 5).	all	V2.80

Subsystem POWer...:CONTrol

The subsystem *POWer:NBURst...:CONTrol* defines the repetition mode, statistic count, and stop condition of the measurement. These settings are provided in the *Control* and *Statistics* tabs in the popup menu *Power Configuration.*

CONFigure:POWer:NBURst:GMSK:CCH:CONTrol <*Mode*>, <*Statistics*>, <*Repetition*>, <*StopCond*>, <*Stepmode*>
CONFigure:POWer:NBURst:GMSK:TCH:CONTrol <*Mode*>, <*Statistics*>, <*Repetition*>, <*StopCond*>, <*Stepmode*>
CONFigure:POWer:NBURst:EPSK:TCH:CONTrol <*Mode*>, <*Statistics*>, <*Repetition*>, <*StopCond*>, <*Stepmode*>

Scope of Measurement

<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
SCALar |	Scalar values only (incl. ramp matching)	ARRay	–	–
ARRay,	Scalar measured values and arrays			

<Statistics>	Description of parameters	Def. value	Def. unit	Unit ring
1 to 1000 |	Number of bursts per statistics cycle	100	–	–
NONE	Statistics off (equivalent to 1)			

<Repetition>	Description of parameters	Def. value	Def. unit	Unit ring
CONTinuous |	Continuous measurement (until `STOP` or `ABORT`)	SING	–	–
SINGleshot |	Single shot measurement (until `Status = RDY`)			
1 to 10000,	Multiple measurement (*counting*, until `Status = STEP | RDY`)			

<StopCond>	Description of parameters	Def. value	Def. unit	Unit ring
SOERror |	Stop measurement in case of error *(stop on error)*	NONE	–	–
NONE,	Continue measurement even in case of error			

<Stepmode>	Description of parameters	Def. value	Def. unit	Unit ring
STEP |	Interrupt measurement after each statistics cycle	NONE	–	–
NONE	Continue measurement according to its rep. mode			

Description of command	Sig. State	FW vers.
This command defines the scope of the power measurement, combining the `...CONTrol:RMODe`, `...CONTrol:STATistics`, and the `...CONTrol:REPetition` commands (see below).	all	V2.80

CONFigure:POWer:NBURst:GMSK:CCH:CONTrol:RMODe *<Mode>* Result Mode
CONFigure:POWer:NBURst:GMSK:TCH:CONTrol:RMODe *<Mode>*
CONFigure:POWer:NBURst:EPSK:TCH:CONTrol:RMODe *<Mode>*

<Mode>	Desciption of parameters	Def. value	Def. unit	Unit ring
SCALar |	Scalar values only (incl. ramp matching)	ARRay	–	–
ARRay,	Scalar measured values and arrays			

Description of command	Sig. State	FW vers.
This command specifies the type of measured values.	all	V2.80

CONFigure:POWer:NBURst:GMSK:CCH:CONTrol:STATistics *<Statistics>* Statistics Count
CONFigure:POWer:NBURst:GMSK:TCH:CONTrol:STATistics *<Statistics>*
CONFigure:POWer:NBURst:EPSK:TCHCONTrol:STATistics *<Statistics>*

<Statistics>	Description of parameters	Def. value	Def. unit	Unit ring
1 to 1000 |	Number of bursts per statistics cycle	100	–	–
NONE	Statistics off (equivalent to 1)			

Description of command	Sig. State	FW vers.
This command defines the number of bursts forming a statistics cycle.	all	V2.80

CONFigure:POWer:NBURst:GMSK:CCH:CONTrol:REPetition
CONFigure:POWer:NBURst:GMSK:TCH:CONTrol:REPetition
CONFigure:POWer:NBURst:EPSK:TCH:CONTrol:REPetition
<Repetition>,<StopCond>,<Stepmode> Test Cycles

<Repetition>	Description of parameters	Def. value	Def. unit	Unit ring
CONTinuous | **SINGleshot |** **1 to 10000,**	Continuous measurement (until `STOP` or `ABORT`) Single shot measurement (until `Status = RDY`) Multiple measurement (*counting*, until `Status = STEP | RDY`)	SING	–	–
<StopCondition>	Description of parameters	Def. value	Def. unit	Unit ring
SOERror | **NONE,**	Stop measurement in case of error *(stop on error)* Continue measurement even in case of error	NONE	–	–
<Stepmode>	Description of parameters	Def. value	Def. unit	Unit ring
STEP | **NONE**	Interrupt measurement after each statistics cycle Continue measurement according to its rep. mode	NONE	–	–

Description of command	Sig. State	FW vers.
This command determines the number of statistics cycles, the stop condition and the stepping mode for the measurement. **Note:** *In the case of READ commands (`READ:...`), the <Repetition> parameter has no effect; the measurement is always stopped after a single shot.*	all	V2.80

DEFault:POWer:NBURst:GMSK:CCH:CONTrol *<Enable>*
DEFault:POWer:NBURst:GMSK:TCH:CONTrol *<Enable>*
DEFault:POWer:NBURst:EPSK:TCH:CONTrol *<Enable>* Default Settings

<Enable>	Description of parameters	Def. value	Def. unit	Unit ring
ON | **OFF**	All parameters are set to their default values Some or all parameters differ from the default values	ON	–	

Description of command	Sig. State	FW vers.
If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to their default values (the setting *OFF* has no effect). If used as a query the command returns whether all parameters are set to their default values *(ON)* or not *(OFF)*.	all	V2.80

Test Configuration

The commands of the following subsystems define the parameters of the signal power measurement. GSM signals are transferred in the form of bursts, which are divided up into different tolerance ranges according to the standard. This is shown in chapter 4 for normal and access bursts.

Subsystem POWer...:LIMit:LINE

The subsystem *POWer ...:LIMit:LINE* defines the limit lines and thus the tolerance values for the power measurement. The subsystem corresponds to the tab *Limit Lines* in the popup menu *Power Configuration.*

Upper Limit Line

```
CONFigure:POWer:NBURst:GMSK:CCH:LIMit:LINE:ASYMmetric:UPPer:AREA<nr>
CONFigure:POWer:NBURst:GMSK:TCH:LIMit:LINE:ASYMmetric:UPPer:AREA<nr>
CONFigure:POWer:NBURst:EPSK:TCH:LIMit:LINE:ASYMmetric:UPPer:AREA<nr>
        <StartTime>, <EndTime>, <StartRelLevel>, <EndRelLevel>,
        <StartAbsLevel>, <EndAbsLevel>, <Visibility>

CONFigure:POWer:NBURst:GMSK:CCH:LIMit:LINE:ASYMmetric:UPPer:AREA<nr>:ENABle
CONFigure:POWer:NBURst:GMSK:TCH:LIMit:LINE:ASYMmetric:UPPer:AREA<nr>:ENABle
CONFigure:POWer:NBURst:EPSK:TCH:LIMit:LINE:ASYMmetric:UPPer:AREA<nr>:ENABle
        <Enable>

CONFigure:POWer:NBURst:GMSK:CCH:LIMit:LINE:ASYMmetric:UPPer:AREA<nr>:VALue
CONFigure:POWer:NBURst:GMSK:TCH:LIMit:LINE:ASYMmetric:UPPer:AREA<nr>:VALue
CONFigure:POWer:NBURst:EPSK:TCH:LIMit:LINE:ASYMmetric:UPPer:AREA<nr>:VALue
        <StartTime>, <EndTime>, <StartRelLevel>, <EndRelLevel>,
        <StartAbsLevel>, <EndAbsLevel>
```

Parameters	Value range	Description of parameters	Def. value
<Enable>	ON | OFF	Definition section on/off	See below
<StartTime>,	–10 bit/symb. to 157.25 bit/symb. | OFF	Start point of time	
<EndTime>,	–10 bit/symb. to 157.25 bit/symb. | OFF	End point of time	
<StartRelLevel>,	–100 dB .. 10 dB | OFF,	Start point of level (relative)	
<EndRelLevel>,	–100 dB .. 10 dB | OFF,	End point of level (relative)	
<StartAbsLevel>,	–90 dBm .. 30 dBm | OFF,	Start point of level (absolute)	
<EndAbsLevel>,	–90 dBm .. 30 dBm | OFF,	End point of level (absolute)	
<Visibility>	ON | OFF	Range of limit lines on/off	

Description of command	Sig. State	FW vers.
These commands activate and define upper limit lines for normal bursts. The limit lines are defined area by area; the suffix <nr> numbers the various areas in the burst diagram (see chapter 4).		V2.80

8 areas are defined in the default setting, another 8 areas can be activated if required. The default settings for GSM400/900/1800 at GMSK modulation in the defined areas are given in the table below:

	for Enable	forTable						
Suffix	Enable	Start Time / [bit]	Stop Time / [bit]	Start rel.Level	Stop rel.Level	Start abs.Level	Stop abs.Level	Visibility
1	ON	–10.00	–7.25	–30.0 dB	–30.0 dB	OFF	OFF	ON
2	ON	–7.25	–4.50	–30.0 dB	–30.0 dB	OFF	OFF	ON
3	ON	–4.50	–2.25	–6.0 dB	–6.0 dB	OFF	OFF	ON
4	ON	–2.25	0.50	+4.0 dB	+4.0 dB	OFF	OFF	ON
5	ON	0.50	150.25	+1.0 dB	+1.0 dB	OFF	OFF	ON
6	ON	150.25	152.50	–6.0 dB	–6.0 dB	OFF	OFF	ON
7	ON	152.50	155.25	–30.0 dB	–30.0 dB	OFF	OFF	ON
8	ON	155.25	157.00	–30.0 dB	–30.0 dB	OFF	OFF	ON

The setting *Visibility* = *Off* implies that the corresponding range, including the limit check, is switched off. The setting *Enable* = *Off* switches off the entire limit check.

Note: *In the* CCH Test *(command ... `:GMSK:CCH`...), the upper limit lines are switched off at the rising and falling edge of the burst (areas no. 1 to 3 and 6 to 8).*

The default settings for GSM1900 at GMSK modulation in the defined areas are given in the table below:

	for Enable	forTable						
Suffix	Enable	Start Time / [bit]	Stop Time / [bit]	Start rel.Level	Stop rel.Level	Start abs.Level	Stop abs.Level	Visibility
1	ON	–10.00	–7.25	–30.0 dB	–30.0 dB	OFF	OFF	ON
2	ON	–7.25	–4.50	–30.0 dB	–30.0 dB	OFF	OFF	ON
3	ON	–4.50	–2.25	–30.0 dB	0.0 dB	OFF	OFF	ON
4	ON	–2.25	0.50	+4.0 dB	+4.0 dB	OFF	OFF	ON
5	ON	0.50	150.25	+1.0 dB	+1.0 dB	OFF	OFF	ON
6	ON	150.25	152.50	0.0 dB	–30.0 dB	OFF	OFF	ON
7	ON	152.50	155.25	–30.0 dB	–30.0 dB	OFF	OFF	ON
8	ON	155.25	157.00	–30.0 dB	–30.0 dB	OFF	OFF	ON

Note: *In the* CCH Test *(command ... `:GMSK:CCH`...), the upper limit lines are switched off at the rising and falling edge of the burst (areas no. 1 to 3 and 6 to 8).*

The default settings for all GSM bands at 8PSK modulation in the defined areas are given in the table below:

	for Enable	forTable						
Suffix	Enable	Start Time / [symb]	Stop Time / [symb]	Start rel.Level	Stop rel.Level	Start abs.Level	Stop abs.Level	Visibility
1	ON	–10.00	–7.00	–30.0 dB	–30.0 dB	OFF	OFF	ON
2	ON	–7.00	–4.50	–30.0 dB	–30.0 dB	OFF	OFF	ON
3	ON	–4.50	–2.25	–6.0 dB	–6.0 dB	OFF	OFF	ON
4	ON	–2.25	0.50	+4.0 dB	+4.0 dB	OFF	OFF	ON
5	ON	0.50	1.5	+2.4 dB	+2.4 dB	OFF	OFF	ON
6	ON	1.50	146.5	+4.0 dB	+4.0 dB	OFF	OFF	ON
7	ON	146.50	147.5	+2.4 dB	+2.4 dB	OFF	OFF	ON
8	ON	147.50	150.25	+4.0 dB	+4.0 dB	OFF	OFF	ON
9	ON	150.25	152.50	–6.0 dB	–6.0 dB	OFF	OFF	ON
10	ON	152.50	155.00	–30.0 dB	–30.0 dB	OFF	OFF	ON
11	ON	155.00	157.00	–30.0 dB	–30.0 dB	OFF	OFF	ON

Lower Limit Line

CONFigure:POWer:NBURst:GMSK:CCH:LIMit:LINE:ASYMmetric:LOWer:AREA<nr>
CONFigure:POWer:NBURst:GMSK:TCH:LIMit:LINE:ASYMmetric:LOWer:AREA<nr>
CONFigure:POWer:NBURst:EPSK:TCH:LIMit:LINE:ASYMmetric:LOWer:AREA<nr>
<StartTime>, <EndTime>, <StartRelLevel>, <EndRelLevel>,
<StartAbsLevel>, <EndAbsLevel>, <Visibility>
CONFigure:POWer:NBURst:GMSK:CCH:LIMit:LINE:ASYMmetric:LOWer:AREA<nr>:ENABle
CONFigure:POWer:NBURst:GMSK:TCH:LIMit:LINE:ASYMmetric:LOWer:AREA<nr>:ENABle
CONFigure:POWer:NBURst:EPSK:TCH:LIMit:LINE:ASYMmetric:LOWer:AREA<nr>:ENABle
<Enable>
CONFigure:POWer:NBURst:GMSK:CCH:LIMit:LINE:ASYMmetric:LOWer:AREA<nr>:VALue
CONFigure:POWer:NBURst:GMSK:TCH:LIMit:LINE:ASYMmetric:LOWer:AREA<nr>:VALue
CONFigure:POWer:NBURst:EPSK:TCH:LIMit:LINE:ASYMmetric:LOWer:AREA<nr>:VALue
<StartTime>, <EndTime>, <StartRelLevel>, <EndRelLevel>,
<StartAbsLevel>, <EndAbsLevel>

Parameters	Value range	Description of parameters	Def. value
<Enable>	ON | OFF	Definition section on/off	See below
<StartTime>,	–10 bit/symb. to 157.25 bit/symb. | OFF	Start point of time	
<EndTime>,	–10 bit/symb. to 157.25 bit/symb. | OFF	End point of time	
<StartRelLevel>,	–100 dB .. 10 dB | OFF,	Start point of level (relative)	
<EndRelLevel>,	–100 dB .. 10 dB | OFF,	End point of level (relative)	
<StartAbsLevel>,	–90 dBm .. 30 dBm | OFF,	Start point of level (absolute)	
<EndAbsLevel>,	–90 dBm .. 30 dBm | OFF,	End point of level (absolute)	
<Visibility>	ON | OFF	Range of limit lines on/off	

Description of command	Sig. State	FW vers.
These commands activate and define lower limit lines for normal bursts. The limit lines are defined area by area; the suffix <nr> numbers the various areas in the burst diagram (Fig. 6-1).	all	V2.80

Only 1 area is defined in the default setting, another 15 areas can be activated if required. The default settings are shown in the table below:

	forEnable	forTable						
Suffix	Enable	Start Time / [bit]	Stop Time / [bit]	Start rel.Level	Stop rel.Level	Start abs.Level	Stop abs.Level	Visibility
1	ON	–20	0	OFF	OFF	OFF	OFF	ON
2	ON	0	147	–1.0dB	–1.0dB	OFF	OFF	ON
3	ON	147	180	OFF	OFF	OFF	OFF	ON

Note: *In the CCH Test (command ... :* `GMSK:CCH`*...), the lower limit lines are entirely switched off.*

The default settings for all GSM bands at 8PSK modulation in the defined areas are given in the table below:

	for Enable	forTable						
Suffix	Enable	Start Time / [symb]	Stop Time / [symb]	Start rel.Level	Stop rel.Level	Start abs.Level	Stop abs.Level	Visibility
1	ON	–10.00	0.50	OFF	OFF	OFF	OFF	ON
2	ON	0.50	1.0	–2.0 dB	–2.0 dB	OFF	OFF	ON
3	ON	1.0	1.5	0.0 dB	0.0 dB	OFF	OFF	ON
4	ON	1.50	146.50	–15.0 dB	–15.0 dB	OFF	OFF	ON
7	ON	146.50	147.00	0.0 dB	0.0 dB	OFF	OFF	ON
8	ON	147.00	147.50	–2.0 dB	–2.0 dB	OFF	OFF	ON
7	ON	147.50	157.00	OFF	OFF	OFF	OFF	ON

CONFigure:POWer:NBURst:GMSK:CCH:LIMit:LINE:ASYMmetric:UPPer:ENABle <*Mode*>
CONFigure:POWer:NBURst:GMSK:TCH:LIMit:LINE:ASYMmetric:UPPer:ENABle <*Mode*>
CONFigure:POWer:NBURst:EPSK:TCH:LIMit:LINE:ASYMmetric:UPPer:ENABle <*Mode*>

Upper Limit Line on/off

<*Mode*>	Description of parameters	Def. value	Def. unit	Unit ring
ON | **OFF**	Switch on upper limit lines Switch off upper limit lines	ON	–	–

Description of command	Sig. State	FW vers.
This command switches the upper limit lines for the active burst type (normal burst) on or off.	all	V2.80

CONFigure:POWer:NBURst:GMSK:CCH:LIMit:LINE:ASYMmetric:LOWer:ENABle <*Mode*>
CONFigure:POWer:NBURst:GMSK:TCH:LIMit:LINE:ASYMmetric:LOWer:ENABle <*Mode*>
CONFigure:POWer:NBURst:EPSK:TCH:LIMit:LINE:ASYMmetric:LOWer:ENABle <*Mode*>

Lower Limit Line on/off

<*Mode*>	Description of parameters	Def. value	Def. unit	Unit ring
ON | **OFF**	Switch on lower limit lines Switch off lower limit lines	ON	–	–

Description of command	Sig. State	FW vers.
This command switches the lower limit lines for the active burst type (normal burst) on or off.	all	V2.80

DEFault:POWer:NBURst:GMSK:CCH:LIMit:LINE <*Enable*>
DEFault:POWer:NBURst:GMSK:TCH:LIMit:LINE <*Enable*>
DEFault:POWer:NBURst:EPSK:TCH:LIMit:LINE <*Enable*>

Default Settings

<*Enable*>	Description of parameters	Def. value	Def. unit	Unit ring
ON | **OFF**	All parameters are set to their default values Some or all parameters differ from the default values	ON	–	

Description of command	Sig. State	FW vers.
If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to their default values (the setting *OFF* has no effect). If used as a query the command returns whether all parameters are set to their default values *(ON)* or not *(OFF)*.	all	V2.80

Subsystem POWer...:TIME

The subsystem *POWer...:TIME* contains the command for shifting the time axis (and thus the tolerance mask). The subsystem corresponds to the value popup *Time – Mode* in the graphical measurement menu *Power.*

CONFigure:POWer:NBURst:GMSK:CCH:TIME:BOFFset <*Mode*> **CONFigure:POWer:NBURst:GMSK:TCH:TIME:BOFFset <*Mode*>** **CONFigure:POWer:NBURst:EPSK:TCH:TIME:BOFFset <*Mode*>**				Bit Offset
<*Mode*>	Description of parameters	Def. value	Def. unit	Unit ring
–4.00 to +4.00	Number of bits (GMSK) or symbols (8PSK)	0	(bit/symb)	
Description of command			Sig. State	FW vers.
This command defines an offset time in ¼ bit or symbol units by which the burst is shifted relative to the time axis and the tolerance template.			all	V2.80

Subsystem POWer[:NBURst]...:RPMode

The subsystem *POWer[:NBURst]...:RPMode* contains the command determining the way how the reference power is calculated in 8PSK modulation. The subsystem corresponds to the *Ref. Power Mode* parameter in the *Control* tab of the *Power Configuration* menu.

CONFigure:POWer:NBURst:EPSK:TCH:RPMode <*Mode*>				Ref. Power Mode
<*Mode*>	Description of parameters	Def. value	Def. unit	Unit ring
CURRent | **AVERage |** **DCOMpens**	Ref. Power calculated from current burst Ref. Power calculated from average curve Data compensated/corrected reference power	CURR	–	
Description of command				FW vers.
This command determines how the reference power (0-dB line in the *P/t Norm. 8PSK* test diagram) for 8PSK-modulated signals is calculated.				V2.80

Subsystem SUBarrays:POWer

The subsystem *SUBarrays:POWer* defines the measurement range and the type of output values.

CONFigure:SUBarrays:POWer:NBURst:GMSK:CCH
CONFigure:SUBarrays:POWer:NBURst:GMSK:TCH
CONFigure:SUBarrays:POWer:NBURst:EPSK:TCH
<Mode>,<Start>,<Samples>{,<Start>,<Samples>}

Definition of Subarrays

<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
ALL | **ARIThmetical |** **MINimum |** **MAXimum,**	Return all measurement values Return arithm. mean value in every range Return minimum value in every range Return maximum value in every range	ALL	–	
<Start>	**Description of parameters**	**Def. value**	**Def. unit**	**Unit ring**
–10 bit to 156 ¾ bit,	Start time in current range (in bit for GMSK, symbols for 8PSK modulation)	–10	bit / symb	
<Samples>	**Description of parameters**	**Def. value**	**Def. unit**	**Unit ring**
0 to 668	Number of samples in current range	668	–	

Description of command	Sig. State	FW vers.
This command configures the `READ:SUBarrays:POWer...`, `FETCh:SUBarrays:POWer...`, and `SAMPle:SUBarrays:POWer` commands. It restricts the measurement to up to 32 subranges where either all measurement results (the number of which is given by the second numerical parameter) or a single statistical value is returned. The subranges are defined by the start time and the number of test points which are located on a fixed, equidistant grid with a step width of ¼ bit. The subranges may overlap but must be within the total range of the *POWer* measurement. Test points outside this range are not measured (result *NAN)* and do not enter into the ARIThmetical, MINimum and MAXimum values. By default, only one range corresponding to the total measurement range is used and all measurement values are returned.	all	V2.80

Measured Values

The commands of the following subsystems determine and output the results of the signal power measurement. They correspond to the graphical menu *Power* with its various display elements.

Subsystem POWer...

The subsystem *POWer...* measures the burst power and compares it with tolerance values. The subsystem corresponds to the graphical measurement menu *Power*.

READ[:SCALar]:POWer:NBURst:GMSK:CCH?
READ[:SCALar]:POWer:NBURst:GMSK:TCH?
READ[:SCALar]:POWer:NBURst:EPSK:TCH?

Scalar results:
Start single shot measurement and return results

FETCh[:SCALar]:POWer:NBURst:GMSK:CCH?
FETCh[:SCALar]:POWer:NBURst:GMSK:TCH?
FETCh[:SCALar]:POWer:NBURst:EPSK:TCH?

Read out measurement results (unsynchronized)

SAMPle[:SCALar]:POWer:NBURst:GMSK:CCH?
SAMPle[:SCALar]:POWer:NBURst:GMSK:TCH?
SAMPle[:SCALar]:POWer:NBURst:EPSK:TCH?

Read out measurement results (synchronized)

Return	Value range	Def. value	Def. unit	Unit ring
BurstsOutOfTol,	0.0 % to 100.0 %	NAN	%	
AvgBurstPower,	–100.0 dBm to +20.0 dBm	NAN	dBm	
PeakBurstPower,	–100.0 dBm to +20.0 dBm	NAN	dBm	
BurstMatching,	MATC | NMAT | INV | NTSC | OUT | NTRG | UFLW | OFLW	INV	–	
AvgBurstPwAverage	–100.0 dBm to +20.0 dBm	NAN	dBm	

Description of command	Sig. State	FW vers.
These commands are always queries. They start the power measurement and output the result. For details refer to the description of measurement control in chapter 5 of the CMU200 operating manual.	CCH TCH	V2.80

The results are:

Bursts out of tolerance (percentage)
Average power of current burst
Peak power of current burst
Average power of averaged trace *Burst template matching*

The calculation of results in an *average* or *peak* measurement is described in chapter 3 (cf. *display modes*).The following messages may be output for the value *BurstMatching*:

MATC	*matching*
NMAT	*not matching*
INV	*invalid*
NTSC	*no training sequence code*
OUT	*out of range*
NTRG	*not triggered*
UFLW	*underflow*
OFLW	*overflow*

CALCulate[:SCALar]:POWer:NBURst:GMSK:CCH:MATChing:LIMit?
CALCulate[:SCALar]:POWer:NBURst:GMSK:TCH:MATChing:LIMit?
CALCulate[:SCALar]:POWer:NBURst:EPSK:TCH:MATChing:LIMit?

Limit Matching

Return	Value range	Def. value	Def. unit	Unit ring
AvgBurstPower,	NMAU | NMAL | INV | OK	INV	–	–
PeakBurstPower,	NMAU | NMAL | INV | OK	INV	–	
BurstMatching,	MATC | NMAT | INV | NTSC | OUT | NTRG | UFLW | OFLW	INV	–	
AvgBurstPwAverage	NMAU | NMAL | INV | OK	INV	–	

Description of command	Sig. State	FW vers.
	CCH TCH	V2.80

This command is always a query. It indicates whether and in which way the permissible tolerances for the scalar measured values (see command above) have been exceeded.

The following messages may be output for the values *AvgBurstPower and PeakBurstPower*:

NMAU	Tolerance value underflow	*not matching, underflow*
NMAL	Tolerance value exceeded	*not matching, overflow*
INV	Measurement invalid	*invalid*
OK	Tolerance value matched	

The following messages may be output for the value *BurstMatching*:

MATC	*matching*
NMAT	*not matching*
INV	*invalid*
NTSC	*no training sequence code*
OUT	*out of range*
NTRG	*not triggered*
UFLW	*underflow*
OFLW	*overflow*

READ:ARRay:POWer:NBURst:GMSK:CCH:CURRent?
READ:ARRay:POWer:NBURst:GMSK:TCH:CURRent?
READ:ARRay:POWer:NBURst:EPSK:TCH:CURRent?
READ:ARRay:POWer:NBURst:GMSK:CCH:AVERage?
READ:ARRay:POWer:NBURst:GMSK:TCH:AVERage?
READ:ARRay:POWer:NBURst:EPSK:TCH:AVERage?
READ:ARRay:POWer:NBURst:GMSK:CCH:MAXimum?
READ:ARRay:POWer:NBURst:GMSK:TCH:MAXimum?
READ:ARRay:POWer:NBURst:EPSK:TCH:MAXimum?
READ:ARRay:POWer:NBURst:GMSK:CCH:MINimum?
READ:ARRay:POWer:NBURst:GMSK:TCH:MINimum?
READ:ARRay:POWer:NBURst:EPSK:TCH:MINimum?

Burst Power

Start measurement and return results *RUN*

FETCh:ARRay:POWer:NBURst:GMSK:CCH:CURRent?
FETCh:ARRay:POWer:NBURst:GMSK:TCH:CURRent?
FETCh:ARRay:POWer:NBURst:EPSK:TCH:CURRent?
FETCh:ARRay:POWer:NBURst:GMSK:CCH:AVERage?
FETCh:ARRay:POWer:NBURst:GMSK:TCH:AVERage?
FETCh:ARRay:POWer:NBURst:EPSK:TCH:AVERage?
FETCh:ARRay:POWer:NBURst:GMSK:CCH:MAXimum?
FETCh:ARRay:POWer:NBURst:GMSK:TCH:MAXimum?
FETCh:ARRay:POWer:NBURst:EPSK:TCH:MAXimum?
FETCh:ARRay:POWer:NBURst:GMSK:CCH:MINimum?
FETCh:ARRay:POWer:NBURst:GMSK:TCH:MINimum?
FETCh:ARRay:POWer:NBURst:EPSK:TCH:MINimum?

Read meas. results (unsynchronized) *RUN*

```
SAMPle:ARRay:POWer:NBURst:GMSK:CCH:CURRent?
SAMPle:ARRay:POWer:NBURst:GMSK:TCH:CURRent?
SAMPle:ARRay:POWer:NBURst:EPSK:TCH:CURRent?
SAMPle:ARRay:POWer:NBURst:GMSK:CCH:AVERage?
SAMPle:ARRay:POWer:NBURst:GMSK:TCH:AVERage?
SAMPle:ARRay:POWer:NBURst:EPSK:TCH:AVERage?
SAMPle:ARRay:POWer:NBURst:GMSK:CCH:MAXimum?
SAMPle:ARRay:POWer:NBURst:GMSK:TCH:MAXimum?
SAMPle:ARRay:POWer:NBURst:EPSK:TCH:MAXimum?
SAMPle:ARRay:POWer:NBURst:GMSK:CCH:MINimum?
SAMPle:ARRay:POWer:NBURst:GMSK:TCH:MINimum?
SAMPle:ARRay:POWer:NBURst:EPSK:TCH:MINimum?
```

Read results (synchronized) *RUN*

Return	Description of parameters	Def. value	Def. unit	Unit ring
–100 dB to + 20.0 dB,	Burst Power[1],	NAN	dB	
…,	…	…	…	
–100 dB to + 20.0 dB	Burst Power[668],	NAN	dB	

Description of command	Sig. State	FW vers.
These commands are always queries. They output the different power values of the bursts in a fixed ¼-bit pattern. The number of measured values is 668. The calculation of *current, average, maximum* and *minimum* values is explained in chapter 3 (cf. *display mode*).	CCH TCH	V2.80

Subarray Results

```
READ:SUBarrays:POWer:NBURst:GMSK:CCH:CURRent?
READ:SUBarrays:POWer:NBURst:GMSK:TCH:CURRent?
READ:SUBarrays:POWer:NBURst:EPSK:TCH:CURRent?
READ:SUBarrays:POWer:NBURst:GMSK:CCH:AVERage?
READ:SUBarrays:POWer:NBURst:GMSK:TCH:AVERage?
READ:SUBarrays:POWer:NBURst:EPSK:TCH:AVERage?
READ:SUBarrays:POWer:NBURst:GMSK:CCH:MAXimum?
READ:SUBarrays:POWer:NBURst:GMSK:TCH:MAXimum?
READ:SUBarrays:POWer:NBURst:EPSK:TCH:MAXimum?
READ:SUBarrays:POWer:NBURst:GMSK:CCH:MINimum?
READ:SUBarrays:POWer:NBURst:GMSK:TCH:MINimum?
READ:SUBarrays:POWer:NBURst:EPSK:TCH:MINimum?
```

Start measurement and return resultss *RUN*

```
FETCh:SUBarrays:POWer:NBURst:GMSK:CCH:CURRent?
FETCh:SUBarrays:POWer:NBURst:GMSK:TCH:CURRent?
FETCh:SUBarrays:POWer:NBURst:EPSK:TCH:CURRent?
FETCh:SUBarrays:POWer:NBURst:GMSK:CCH:AVERage?
FETCh:SUBarrays:POWer:NBURst:GMSK:TCH:AVERage?
FETCh:SUBarrays:POWer:NBURst:EPSK:TCH:AVERage?
FETCh:SUBarrays:POWer:NBURst:GMSK:CCH:MAXimum?
FETCh:SUBarrays:POWer:NBURst:GMSK:TCH:MAXimum?
FETCh:SUBarrays:POWer:NBURst:EPSK:TCH:MAXimum?
FETCh:SUBarrays:POWer:NBURst:GMSK:CCH:MINimum?
FETCh:SUBarrays:POWer:NBURst:GMSK:TCH:MINimum?
FETCh:SUBarrays:POWer:NBURst:EPSK:TCH:MINimum?
```

Read meas. results (unsynchronized) *RUN*

```
SAMPle:SUBarrays:POWer:NBURst:GMSK:CCH:CURRent?
SAMPle:SUBarrays:POWer:NBURst:GMSK:TCH:CURRent?
SAMPle:SUBarrays:POWer:NBURst:EPSK:TCH:CURRent?
SAMPle:SUBarrays:POWer:NBURst:GMSK:CCH:AVERage?
```

SAMPle:SUBarrays:POWer:NBURst:GMSK:TCH:AVERage?
SAMPle:SUBarrays:POWer:NBURst:EPSK:TCH:AVERage?
SAMPle:SUBarrays:POWer:NBURst:GMSK:CCH:MAXimum?
SAMPle:SUBarrays:POWer:NBURst:GMSK:TCH:MAXimum?
SAMPle:SUBarrays:POWer:NBURst:EPSK:TCH:MAXimum?
SAMPle:SUBarrays:POWer:NBURst:GMSK:CCH:MINimum?
SAMPle:SUBarrays:POWer:NBURst:GMSK:TCH:MINimum?
SAMPle:SUBarrays:POWer:NBURst:EPSK:TCH:MINimum?

Read results (synchronized) *RUN*

Ret. values per subrange	Description of parameters	Def. value	Def. unit	Unit ring
–100 dB to + 20.0 dB,	BurstPower[1],	NAN	dB	
...,	...	...	...	
–100 dB to + 20.0 dB	BurstPower[n],	NAN	dB	

Description of command	Sig. State	FW vers.
These commands are always queries. They output the burst power versus time in a fixed ¼-bit pattern and in the subranges defined by means of the `CONFigure:SUBarrays:POWer` command. In the default setting of the configuration command the `READ:SUBarrays...`, `FETCh:SUBarrays...`, and `SAMPle:SUBarrays...` command group is equivalent to the `READ:ARRay...`, `FETCh:ARRay...`, and `SAMPle:ARRay...` command group described above. The `CONFigure:SUBarrays:POWer` command defines a maximum of 32 subranges. If one of the statistical modes (`ARIThmetical`, `MINimum`, `MAXimum`) is set, only one value is returned per subrange. The calculation of *current, average, minimum,* and *maximum* results is explained in chapter 3 (cf. *display mode*).	CCH TCH	V2.80

CALCulate:ARRay:POWer:NBURst:GMSK:CCH:AVERage:MATChing:LIMit?
CALCulate:ARRay:POWer:NBURst:GMSK:TCH:AVERage:MATChing:LIMit?
CALCulate:ARRay:POWer:NBURst:EPSK:TCH:AVERage:MATChing:LIMit?
CALCulate:ARRay:POWer:NBURst:GMSK:CCH:CURRent:MATChing:LIMit?
CALCulate:ARRay:POWer:NBURst:GMSK:TCH:CURRent:MATChing:LIMit?
CALCulate:ARRay:POWer:NBURst:EPSK:TCH:CURRent:MATChing:LIMit?
CALCulate:ARRay:POWer:NBURst:GMSK:CCH:MAXimum:MATChing:LIMit?
CALCulate:ARRay:POWer:NBURst:GMSK:TCH:MAXimum:MATChing:LIMit?
CALCulate:ARRay:POWer:NBURst:EPSK:TCH:MAXimum:MATChing:LIMit?
CALCulate:ARRay:POWer:NBURst:GMSK:CCH:MINimum:MATChing:LIMit?
CALCulate:ARRay:POWer:NBURst:GMSK:TCH:MINimum:MATChing:LIMit?
CALCulate:ARRay:POWer:NBURst:EPSK:TCH:MINimum:MATChing:LIMit?

Burst Matching

Return	Value range	Def. value	Def. unit	Unit ring
Matching	MATC | NMAT | INV | NTSC | OUT | NTRG | UFLW | OFLW	INV	–	–

Description of command	Sig. State	FW vers.
This command is always a query. It indicates whether and in which way permissible tolerances for the burst power (see command above) have been exceeded. The following messages may be output for the value *Matching*: MATC *matching* NMAT *not matching* INV *invalid* NTSC *no training sequence code* OUT *out of range* NTRG *not triggered* UFLW *underflow* OFLW *overflow*	CCH TCH	V2.80

CALCulate:ARRay:POWer:NBURst:GMSK:CCH:CURRent:MATChing:AREA?
CALCulate:ARRay:POWer:NBURst:GMSK:TCH:CURRent:MATChing:AREA?
CALCulate:ARRay:POWer:NBURst:EPSK:TCH:CURRent:MATChing:AREA?
CALCulate:ARRay:POWer:NBURst:GMSK:CCH:AVERage:MATChing:AREA?
CALCulate:ARRay:POWer:NBURst:GMSK:TCH:AVERage:MATChing:AREA?
CALCulate:ARRay:POWer:NBURst:EPSK:TCH:AVERage:MATChing:AREA?
CALCulate:ARRay:POWer:NBURst:GMSK:CCH:MAXimum:MATChing:AREA?
CALCulate:ARRay:POWer:NBURst:GMSK:TCH:MAXimum:MATChing:AREA?
CALCulate:ARRay:POWer:NBURst:EPSK:TCH:MAXimum:MATChing:AREA?
CALCulate:ARRay:POWer:NBURst:GMSK:CCH:MINimum:MATChing:AREA?
CALCulate:ARRay:POWer:NBURst:GMSK:TCH:MINimum:MATChing:AREA?
CALCulate:ARRay:POWer:NBURst:EPSK:TCH:MINimum:MATChing:AREA?

Range Violation

Returned value	Description of parameters	Def. value	Def. unit	Unit ring
32 bit field,	Indicator for upper limit matching in area 1 to 16 (16 least significant bits),	NAN	–	–
32 bit field	Indicator for lower limit matching in area 1 to 16 (16 least significant bits)	NAN	–	–

Description of command	Sig. State	FW vers.
This command is always a query. Any set bit of the two returned fields indicates the violation of the corresponding section of the limit lines.	CCH TCH	V2.80

Subsystem POWer:SLOT

The subsystem *POWer:SLOT* controls the *Power vs. Slot* measurement. It corresponds to the measurement menu *Power* with the application *P/Slot*: *Power vs. Slot* measurements are available in the TCH test mode and for GMSK modulation only.

INITiate:POWer:SLOT:GMSK:TCH	Start new measurement	*RUN*
ABORt:POWer:SLOT:GMSK:TCH	Abort running measurement and switch off	*OFF*
STOP:POWer:SLOT:GMSK:TCH	Stop measurement after current stat. cycle	*STOP*
CONTinue:POWer:SLOT:GMSK:TCH	Next measurement step (only *stepping mode*)	*RUN*

Description of command	Sig. State	FW vers.
These commands do not exist as queries. They start or stop the measurement, setting it to the status indicated in the top right column.	CCH TCH	V2.80

CONFigure:POWer:SLOT:GMSK:TCH:EREPorting *<Mode>* Event Reporting

<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
SRQ |	Service request	OFF	–	–
SOPC |	Single operation complete			
SRSQ |	SRQ and SOPC			
OFF	No reporting			

Description of command	Sig. State	FW vers.
This command defines the events generated when the measurement is terminated or stopped (*event reporting*, see chapter 5 of CMU200 manual).	all	V2.80

FETCh:POWer:SLOT:GMSK:TCH:STATus? Measurement Status

Return	Description of parameters	Def. value	Def. unit	Unit ring
OFF |	Measurement in the *OFF* state (`*RST` or `ABORt`)	OFF	–	–
RUN |	Running (after `INITiate`, `CONTinue` or `READ`)			
STOP |	Stopped (`STOP`)			
ERR |	*OFF* (could not be started)			
STEP |	Stepping mode *(<stepmode>=STEP)*			
RDY,	Stopped according to repetition mode and stop condition			
1 to 10000 |	Counter for current statistics cycle			
NONE	No counting mode set	NONE	–	–

Description of command	Sig. State	FW vers.
This command is always a query. It returns the status of the measurement (see chapters 3 and 5).	all	V2.80

Subsystem POWer:SLOT:GMSK:CONTrol

CONFigure:POWer:SLOT:GMSK:TCH:CONTrol:REPetition
<Repetition>,<StopCond>,<Stepmode> Test Cycles

<Repetition>	Description of parameters	Def. value	Def. unit	Unit ring
CONTinuous |	Continuous measurement (*continuous*, until `STOP` or `ABORT`)	SING	–	–
SINGleshot |	Single measurement *(single shot*, `until Status = RDY`)			
1 to 10000,	Multiple measurement (*counting*, until `Status = STEP | RDY`)			
<StopCond>	Description of parameters	Def. value	Def. unit	Unit ring
SOERror | **NONE,**	Stop measurement in case of error *(stop on error)* Continue measurement even in case of error	NONE	–	–
<Stepmode>	Description of parameters	Def. value	Def. unit	Unit ring
STEP | **NONE**	Interrupt measurement after each statistics cycle Continue measurement according to its rep. mode	NONE	–	–

Description of command	Sig. State	FW vers.
This command determines the number of statistics cycles and the stepping mode for the measurement. **Note:** *In the case of READ commands (`READ:...`), the <Repetition> parameter has no effect; the measurement is always stopped after a single shot.*	all	V2.80

DEFault:POWer:SLOT:GMSK:TCH:CONTrol *<Enable>* Default Settings

<Enable>	Description of parameters	Def. value	Def. unit	Unit ring
ON | **OFF**	The parameters are set to their default values The parameters differ from the default values (partially or totally)	ON	–	–

Description of command	Sig. State	FW vers.
If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to their default values (the setting *OFF* has no effect). If used as a query the command returns whether all parameters are set to their default values *(ON)* or not *(OFF)*.	all	V2.80

Subsystem POWer:SLOT:GMSK...

The subsystem *POWer:SLOT:GMSK...* contains the commands for measurement and output of the power versus SLOT application for three selected channels. The subsystem corresponds to the measurement menu *P/Slot.*

READ[:SCALar]:POWer:SLOT:GMSK:TCH? **FETCh[:SCALar]:POWer:SLOT:GMSK:TCH?** **SAMPle[:SCALar]:POWer:SLOT:GMSK:TCH?**	Scalar Results Start single shot measurement and return results Read out measurement results (unsynchronized) Read out measurement results (synchronized)			
Return	Value range	Def. value	Def. unit	Unit ring
Slot0, **...,** **Slot7**	see data sheet, ... see data sheet	NAN, ..., NAN	dBm, ..., dBm	
Description of command			Sig. State	FW vers.
These commands are always queries. They start a measurement and return all measurement results. The returned list contains the average burst power of the base station in all eight timeslots of a TDMA frame.			CCH TCH	V2.80

Test Object MODulation:PERRor:GMSK

The subsystem *MODulation:PERRor:GMSK* measures the modulation parameters (frequency and phase errors) in GMSK modulation. The subsystem corresponds to the measurement menu *Modulation*, application *Phase Error GMSK*, and the associated popup menu *Modulation Configuration*.

Important Note!

> *Measurement configurations are generally possible in all signalling states. However, to* `INITiate`, `ABORt`, `STOP`, `CONTinue` *a measurement, and to obtain measurement results, the command* `PROCedure:SIGNalling:ACTion` *must be used to access either the* TCH *mode (commands including the keyword* `:TCH`*; traffic channel tests) or the* CCH *mode (commands including the keyword* `:CCH`*; control channel tests).*

Control of Measurement

The subsystem *MODulation* controls the modulation measurement. It corresponds to the softkey *Phase Err. GMSK* in the measurement menu *Modulation*.

INITiate:MODulation:PERRor:GMSK:CCH **INITiate:MODulation:PERRor:GMSK:TCH**	Start new measurement	*RUN*
ABORt:MODulation:PERRor:GMSK:CCH **ABORt:MODulation:PERRor:GMSK:TCH**	Abort running meas. and switch off	*OFF*
STOP:MODulation:PERRor:GMSK:CCH **STOP:MODulation:PERRor:GMSK:TCH**	Stop meas. after current stat. cycle	*STOP*
CONTinue:MODulation:PERRor:GMSK:CCH **CONTinue:MODulation:PERRor:GMSK:TCH**	Next meas. step (only *stepping mode*)	*RUN*
Description of command	Sig. State	FW vers.
These commands do not exist as queries. They start and stop the modulation measurement, setting it to the status indicated in the top right column.	CCH TCH	V2.80

CONFigure:MODulation:PERRor:GMSK:CCH:EREPorting *<Mode>* **CONFigure:MODulation:PERRor:GMSK:TCH:EREPorting *<Mode>***				Event Reporting
<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
SRQ | **SOPC |** **SRSQ |** **OFF**	Service request Single operation complete SRQ and SRSQ No reporting	OFF	–	–
Description of command			Sig. State	FW vers.
This command defines the events generated when the measurement is terminated or stopped (*event reporting,* see chapter 5).			all	V2.80

FETCh:MODulation:PERRor:GMSK:CCH:STATus?
FETCh:MODulation:PERRor:GMSK:TCH:STATus? Measurement Status

Return	Description of parameters	Def. value	Def. unit	Unit ring
OFF | **RUN |** **STOP |** **ERR |** **STEP |** **RDY,**	Measurement in the *OFF* state (`*RST` or `ABORt`) Running (after `INITiate, CONTinue` or `READ`) Stopped (`STOP`) *OFF* (could not be started) Stepping mode *(<stepmode>=STEP)* Stopped according to repetition mode and stop condition	OFF	–	–
1 to 10000 | **NONE,**	Counter for current statistics cycle No counting mode set	NONE	–	–
1 to 1000 | **NONE**	Counter for current evaluation period within a cycle Statistic count set to off	NONE	–	–
Description of command			Sig. State	FW vers.
This command is always a query. It returns the status of the measurement (see chapters 3 and 5).			all	V2.80

Subsystem MODulation...:CONTrol

The subsystem *MODulation...:CONTrol* configures the modulation measurement. It corresponds to the tabs *Control* and *Statistics* in the popup menu *Modulation Config*.

CONFigure:MODulation:PERRor:GMSK:CCH:CONTrol *<Mode>, <Statistics>, <Repetition>, <StopCond>, <Stepmode>*
CONFigure:MODulation:PERRor:GMSK:TCH:CONTrol *<Mode>, <Statistics>, <Repetition>, <StopCond>, <Stepmode>* Scope of Measurement

<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
SCALar | **ARRay,**	Scalar values only (incl. ramp matching) Scalar measured values and arrays	ARRay	–	–
<Statistics>	Description of parameters	Def. value	Def. unit	Unit ring
1 to 1000 | **NONE**	Number of bursts per statistics cycle Statistics off (equivalent to 1)	100	–	–
<Repetition>	Description of parameters	Def. value	Def. unit	Unit ring
CONTinuous | **SINGleshot |** **1 to 10000,**	Continuous measurement (until `STOP` or `ABORT`) Single shot measurement (until `Status = RDY`) Multiple measurement (*counting*, until `Status = STEP | RDY`)	SING	–	–
<StopCond>	Description of parameters	Def. value	Def. unit	Unit ring
SOERror | **NONE,**	Stop measurement in case of error *(stop on error)* Continue measurement even in case of error	NONE	–	–
<Stepmode>	Description of parameters	Def. value	Def. unit	Unit ring
STEP | **NONE**	Interrupt measurement after each statistics cycle Continue measurement according to its rep. mode	NONE	–	–

Description of command	Sig. State	FW vers.
This command defines the scope of the modulation measurement, combining the `...CONTrol:RMODe`, `...CONTrol:STATistics`, and the `...CONTrol:REPetition` commands (see below).	all	V2.80

CONFigure:MODulation:PERRor:GMSK:CCH:CONTrol:RMODe *<Mode>* Result Mode
CONFigure:MODulation:PERRor:GMSK:TCH:CONTrol:RMODe *<Mode>*

<Mode>	Desciption of parameters	Def. value	Def. unit	Unit ring
SCALar |	Scalar values only (incl. ramp matching)	ARRay	–	–
ARRay,	Scalar measured values and arrays			

Description of command	Sig. State	FW vers.
This command specifies the type of measured values.	all	V2.80

CONFigure:MODulation:PERRor:GMSK:CCH:CONTrol:STATistics *<Statistics>* Statistics Count
CONFigure:MODulation:PERRor:GMSK:TCH:CONTrol:STATistics *<Statistics>*

<Statistics>	Description of parameters	Def. value	Def. unit	Unit ring
1 to 1000 |	Number of bursts per statistics cycle	100	–	–
NONE	Statistics off (equivalent to 1)			

Description of command	Sig. State	FW vers.
This command defines the number of bursts forming a statistics cycle.	all	V2.80

CONFigure:MODulation:PERRor:GMSK:CCH:CONTrol:REPetition
<Repetition>* ,*<StopCond>*,*<Stepmode>
CONFigure:MODulation:PERRor:GMSK:TCH:CONTrol:REPetition
<Repetition>* ,*<StopCond>*,*<Stepmode> Test Cycles

<Repetition>	Description of parameters	Def. value	Def. unit	Unit ring
CONTinuous |	Continuous measurement (until `STOP` or `ABORT`)	SING	–	–
SINGleshot |	Single shot measurement (until `Status = RDY`)			
1 to 10000	Multiple measurement (*counting*, until `Status = STEP | RDY`)			
<StopCondition>	**Description of parameters**	**Def. value**	**Def. unit**	**Unit ring**
SOERror |	Stop measurement in case of error *(stop on error)*	NONE	–	–
NONE	Continue measurement even in case of error			
<Stepmode>	**Description of parameters**	**Def. value**	**Def. unit**	**Unit ring**
STEP |	Interrupt measurement after each statistics cycle	NONE	–	–
NONE	Continue measurement according to its rep. mode			

Description of command	Sig. State	FW vers.
This command determines the number of statistics cycles, the stop condition and the stepping mode for the measurement. **Note:** *In the case of READ commands (`READ:...`), the <Repetition> parameter has no effect; the measurement is always stopped after a single shot.*	all	V2.80

DEFault:MODulation:PERRor:GMSK:CCH:CONTrol <Enable>
DEFault:MODulation:PERRor:GMSK:TCH:CONTrol <Enable> Default Settings

<Enable>	Description of parameters	Def. value	Def. unit	Unit ring
ON | **OFF**	All parameters are set to their default values Some or all parameters differ from the default values	ON	–	–

Description of command	Sig. State	FW vers.
As a *setting command* with the setting *ON* this command sets all parameters of the subsystem to default values (the setting *OFF* has no effect). As a query, this command reads out whether all parameters are set to default values *(ON)* or not *(OFF)*.	all	V2.80

Test Configuration – Subsystem MODulation...:LIMit

The subsystem *MODulation...:LIMit* defines tolerance values for the modulation measurement. The subsystem corresponds to the tab *Limits* in the popup menu *Modulation.*

CONFigure:MODulation:PERRor:GMSK:CCH:CMMax:LIMit[:SCALar]:SYMMetric [:COMBined]:VALue Limits for Current and Min./Max. Trace
CONFigure:MODulation:PERRor:GMSK:TCH:CMMax:LIMit[:SCALar]:SYMMetric [:COMBined]:VALue *<PhaseErrorPeak>, <PhaseErrorRMS>,<FrequencyError>*

Parameter	Description of parameters	Def. value	Def. unit	Unit ring
0.0 to +50.0 deg	PhaseErrorPeak, limit for max. phase error	+20.0	deg	
0.0 to +50.0 deg	PhaseErrorRMS, limit for RMS phase error	+5.0	deg	
0.0 to +1000 Hz	FrequencyError, limit for frequency error	+45	Hz	

Description of command	Sig. State	FW vers.
This command defines upper limits for the peak and RMS phase error as well as for the frequency error in the *Current* and in the *Min./Max.* trace. The default frequency error is 23 Hz for GSM 400, 45 Hz for GSM900, 90 Hz for GSM1800/1900. The measurement is out of tolerance if the measured RMS phase error, the absolute value of the peak phase error, or the absolute value of the frequency error exceeds the specified limits.	all	V2.80

CONFigure:MODulation:PERRor:GMSK:CCH:AVERage:LIMit:[:SCALar]:SYMMetric [:COMBined]:VALue Limits for Average Trace
CONFigure:MODulation:PERRor:GMSK:TCH:AVERage:LIMit:[:SCALar]:SYMMetric [:COMBined]:VALue *<PhaseErrorPeak>, <PhaseErrorRMS>,<FrequencyError>*

Parameter	Description of parameters	Def. value	Def. unit	Unit ring
0.0 to +50.0 deg	PhaseErrorPeak, limit for max. phase error	+20.0	deg	
0.0 to +50.0 deg	PhaseErrorRMS, limit for RMS phase error	+5.0	deg	
0.0 to +1000 Hz	FrequencyError, limit for frequency error	+45	Hz	

Description of command	Sig. State	FW vers.
This command defines upper limits for the peak and RMS phase error as well as for the frequency error in the *Average* trace. The default frequency error is 23 Hz for GSM 400, 45 Hz for GSM900, 90 Hz for GSM1800/1900. The measurement is out of tolerance if the measured RMS phase error, the absolute value of the peak phase error, or the absolute value of the frequency error exceeds the specified limits.	all	V2.80

DEFault:MODulation:PERRor:GMSK:CCH:LIMit
DEFault:MODulation:PERRor:GMSK:TCH:LIMit
Default Settings

<Enable>	Description of parameters	Def. value	Def. unit	Unit ring
ON | **OFF**	All parameters are set to their default values Some or all parameters differ from the default values	ON	–	–

Description of command	Sig. State	FW vers.
As a *setting command* with the setting *ON* this command sets all parameters of the subsystem to default values (the setting *OFF* has no effect). As a query, this command reads out whether all parameters are set to default values *(ON)* or not *(OFF)*.	all	V2.80

Subsystem MODulation...:TIME

The subsystem *MODulation...:TIME* defines the decoding for the Modulation measurement. The subsystem corresponds to the popup window *Decode* in the graphical measurement menu *Modulation*

CONFigure:MODulation:PERRor:GMSK:CCH:TIME:DECode *<Mode>*
CONFigure:MODulation:PERRor:GMSK:TCH:TIME:DECode *<Mode>*
Decode

<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
STANdard | **GTBits**	The standard bit range is decoded The guard and tail bits are also decoded	STANdard	–	–

Description of command	Sig. State	FW vers.
This command selects the type of decoding applied for the determination of phase and frequency errors.	all	V2.80

Subsystem SUBarrays:MODulation

The subsystem *SUBarrays:MODulation* defines the measurement range and the type of output values.

CONFigure:SUBarrays:MODulation:PERRor:GMSK:CCH
CONFigure:SUBarrays:MODulation:PERRor:GMSK:TCH
<Mode>,<Start>,<Samples>{,<Start>,<Samples>} Definition of Subarrays

<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
ALL | **ARIThmetical |** **MINimum |** **MAXimum,**	Return all measurement values Return arithm. mean value in every range Return minimum value in every range Return maximum value in every range	ALL	–	
<Start>	**Description of parameters**	**Def. value**	**Def. unit**	**Unit ring**
0 bit to 146 ¾ bit,	Start time in current range	0	bit	
<Samples>	**Description of parameters**	**Def. value**	**Def. unit**	**Unit ring**
0 to 588	Number of samples in current range	588	–	

Description of command	Sig. State	FW vers.
This command configures the `READ:SUBarrays...`, `FETCh:SUBarrays...`, and `SAMPle:SUBarrays:MODulation` commands. It restricts the measurement to up to 32 subranges where either all measurement results (the number of which is given by the second numerical parameter) or a single statistical value is returned. The subranges are defined by the start time and the number of test points which are located on a fixed, equidistant grid with a step width of ¼ bit. The subranges may overlap but must be within the total range of the *MODulation* measurement. Test points outside this range are not measured (result *NAN)* and do not enter into the ARIThmetical, MINimum and MAXimum values. By default, only one range corresponding to the total measurement range is used and all measurement values are returned.	all	V2.80

Subsystem MODulation...

The subsystem *MODulation...* measures and returns the frequency and phase errors and compares them with the tolerance values. The subsystem corresponds to the different output elements in the graphical measurement menu *Modulation.*

READ[:SCALar]:MODulation:PERRor:GMSK:CCH Scalar results:
READ[:SCALar]:MODulation:PERRor:GMSK:TCH
Start single shot measurement and return results
FETCh[:SCALar]:MODulation:PERRor:GMSK:CCH?
FETCh[:SCALar]:MODulation:PERRor:GMSK:TCH? Read out meas. results (unsynchronized)
SAMPle[:SCALar]:MODulation:PERRor:GMSK:CCH?
SAMPle[:SCALar]:MODulation:PERRor:GMSK:TCH? Read out measurement results (synchronized)

Return	Value range	Def. value	Def. unit	Unit ring
PhErrPeakCurrent,	–100.0 ° to +100.0 °	NAN	deg	
PhErrPeakAverage,	–100.0 ° to +100.0 °	NAN	deg	
PhErrPeakMaxMin,	–100.0 ° to +100.0 °	NAN	deg	
PhErrRMSCurrent,	–100.0 ° to +100.0 °	NAN	deg	
PhErrRMSAverage,	–100.0 ° to +100.0 °	NAN	deg	
PhErrRMSMaxMin,	–100.0 ° to +100.0 °	NAN	deg	
FreqErrCurrent,	–1000.0 Hz to + 1000.0 Hz	NAN	Hz	
FreqErrAverage,	–1000.0 Hz to + 1000.0 Hz	NAN	Hz	
FreqErrMaxMin	–1000.0 Hz to + 1000.0 Hz	NAN	Hz	
AvgBurstPowerCurr	–100.0 dBm to + 20.0 dBm	NAN	dBm	
AvgBurstPowerAvg	–100.0 dBm to + 20.0 dBm	NAN	dBm	
BurstsOutOfTol	0.0 % to 100.0 %	NAN	%	

Description of command	Sig. State	FW vers.
These commands are always queries. They start a measurement and output all scalar measurement results (see chapter 5). These are: Peak phase error of *Current* burst Peak phase error of *Average* trace Peak phase error of *Max./Min.* trace RMS phase error of *Current* burst RMS phase error of *Average* trace RMS phase error of *Max./Min.* trace Frequency error of *Current* burst Frequency error of *Average* trace Frequency error of *Max./Min.* trace Average burst power of current burst Average burst power of average burst Relative portion of faulty bursts The calculation of results in an *Average* or *Max./Min.* measurement is described in chapter 3 (cf. *calculation of statistical quantities*).	CCH TCH	V2.80

CALCulate[:SCALar]:MODulation:PERRor:GMSK:CCH:MATChing:LIMit?
CALCulate[:SCALar]:MODulation:PERRor:GMSK:TCH:MATChing:LIMit? Bursts out of Tolerance

Return	Value range	Def. value	Def. unit	Unit ring
PhErrPeakCurrent,		INV	–	–
PhErrPeakAverage,		INV	–	
PhErrPeakMaxMin,		INV	–	
PhErrRMSCurrent,	**For all measured values:**	INV	–	
PhErrRMSAverage,		INV	–	
PhErrRMSMaxMin,		INV	–	
FreqErrCurrent,	**NMAU |NMAL | INV | OK**	INV	–	
FreqErrAverage,		INV	–	
FreqErrMaxMin		INV	–	
AvgBurstPowerCurr		INV	–	
AvgBurstPowerAvg		INV	–	

Description of command	Sig. State	FW vers.
This command is always a query. It indicates whether and in which way the permissible error limits for the scalar measured values (see command above) have been exceeded. The following messages may be output for all measured values:	CCH TCH	V2.80

NMAU	Underflow of tolerance value	*not matching, underflow*
NMAL	Tolerance value exceeded	*not matching, overflow*
INV	Measurement invalid	*invalid*
OK.	all tolerances matched	

READ:ARRay:MODulation:PERRor:GMSK:CCH:CURRent? Phase Error in Burst
READ:ARRay:MODulation:PERRor:GMSK:TCH:CURRent?
READ:ARRay:MODulation:PERRor:GMSK:CCH:AVERage?
READ:ARRay:MODulation:PERRor:GMSK:TCH:AVERage?
READ:ARRay:MODulation:PERRor:GMSK:CCH:MMAXimum?
READ:ARRay:MODulation:PERRor:GMSK:TCH:MMAXimum?
Start single shot measurement and return results *RUN*
FETCh:ARRay:MODulation:PERRor:GMSK:CCH:CURRent?
FETCh:ARRay:MODulation:PERRor:GMSK:TCH:CURRent?
FETCh:ARRay:MODulation:PERRor:GMSK:CCH:AVERage?
FETCh:ARRay:MODulation:PERRor:GMSK:TCH:AVERage?
FETCh:ARRay:MODulation:PERRor:GMSK:CCH:MMAXimum?
FETCh:ARRay:MODulation:PERRor:GMSK:TCH:MMAXimum?
Read measurement results (unsynchronized) *RUN*
SAMPle:ARRay:MODulation:PERRor:GMSK:CCH:CURRent?
SAMPle:ARRay:MODulation:PERRor:GMSK:TCH:CURRent?
SAMPle:ARRay:MODulation:PERRor:GMSK:CCH:AVERage?
SAMPle:ARRay:MODulation:PERRor:GMSK:TCH:AVERage?
SAMPle:ARRay:MODulation:PERRor:GMSK:CCH:MMAXimum?
SAMPle:ARRay:MODulation:PERRor:GMSK:TCH:MMAXimum?
Read measurement results (synchronized) *RUN*

Return	Description of parameters	Def. value	Def. unit	Unit ring
–100.0 deg to + 100.0 deg	Phase Error [1],	NAN	deg	–
...	...	...	...	
–100.0 deg to + 100.0 deg	Phase Error [588]	NAN	deg	

Description of command	Sig. State	FW vers.
These commands are always queries. They return the values for the phase error of the burst in a fixed ¼-bit pattern. The number of measured values is 588, corresponding to a time range of 0 bit to 146 ¾ bit. The calculation of *current, average, minimum* and *maximum* results is explained in chapter 3 (cf. *display mode*).	CCH TCH	V2.80

READ:SUBarrays:MODulation:PERRor:GMSK:CCH:CURRent? Subarray Results
READ:SUBarrays:MODulation:PERRor:GMSK:TCH:CURRent?
READ:SUBarrays:MODulation:PERRor:GMSK:CCH:AVERage?
READ:SUBarrays:MODulation:PERRor:GMSK:TCH:AVERage?
READ:SUBarrays:MODulation:PERRor:GMSK:CCH:MMAXimum?
READ:SUBarrays:MODulation:PERRor:GMSK:TCH:MMAXimum?
Start single shot measurement and return results *RUN*
FETCh:SUBarrays:MODulation:PERRor:GMSK:CCH:CURRent?
FETCh:SUBarrays:MODulation:PERRor:GMSK:TCH:CURRent?
FETCh:SUBarrays:MODulation:PERRor:GMSK:CCH:AVERage?
FETCh:SUBarrays:MODulation:PERRor:GMSK:TCH:AVERage?
FETCh:SUBarrays:MODulation:PERRor:GMSK:CCH:MMAXimum?
FETCh:SUBarrays:MODulation:PERRor:GMSK:TCH:MMAXimum?
Read measurement results (unsynchronized) *RUN*
SAMPle:SUBarrays:MODulation:PERRor:GMSK:CCH:CURRent?
SAMPle:SUBarrays:MODulation:PERRor:GMSK:TCH:CURRent?
SAMPle:SUBarrays:MODulation:PERRor:GMSK:CCH:AVERage?
SAMPle:SUBarrays:MODulation:PERRor:GMSK:TCH:AVERage?
SAMPle:SUBarrays:MODulation:PERRor:GMSK:CCH:MMAXimum?
SAMPle:SUBarrays:MODulation:PERRor:GMSK:TCH:MMAXimum?
Read measurement results (synchronized) *RUN*

Ret. values per subrange	Description of parameters	Def. value	Def. unit	Unit ring
–100.0 deg to + 20.0 deg	Phase Error [1],	NAN	deg	
...	...	...	...	
–100.0 deg to + 20.0 deg	Phase Error [n]	NAN	deg	

Description of command	Sig. State	FW vers.
These commands are always queries. They output the phase error versus time in a fixed ¼- bit pattern and in the subranges defined by means of the `CONFigure:SUBarrays:MODulation...` command. In the default setting of the configuration command the `READ:SUBarrays...`, `FETCh:SUBarrays...`, and `SAMPle:SUBarrays...` command group is equivalent to the `READ:ARRay...`, `FETCh:ARRay...`, and `SAMPle:ARRay...` command group described above. The `CONFigure:SUBarrays:MODulation` command defines a maximum of 32 subranges. If one of the statistical modes (`ARIThmetical`, `MINimum`, `MAXimum`) is set, only one value is returned per subrange. The calculation of *current, average, minimum,* and *maximum* results is explained in chapter 3 (cf. *display mode*).	CCH TCH	V2.80

Test Object MODulation:OVERview

The subsystem *MODulation:OVERview:EPSK:TCH* measures general scalar modulation parameters in 8PSK modulation. The subsystem corresponds to the measurement menu *Modulation,* application *Overview 8PSK,* and the associated popup menu *Modulation Configuration.*

Important Note!

> *The keyword* `:EPSK:TCH` *in the remote control commands of this section denotes 8PSK modulation (TCH test). The commands are available with option CMU-K41 only.*

Control of Measurement – Subsystem MODulation:OVERview:EPSK:TCH

The subsystem *MODulation:OVERview:EPSK:TCH* controls the modulation measurement. It corresponds to the softkey *Overview 8PSK* in the measurement menu *Modulation*.

INITiate:MODulation:OVERview:EPSK:TCH	Start new measurement	*RUN*
ABORt:MODulation:OVERview:EPSK:TCH	Abort running measurement and switch off	*OFF*
STOP:MODulation:OVERview:EPSK:TCH	Stop measurement after current stat. cycle	*STOP*
CONTinue:MODulation:OVERview:EPSK:TCH	Next measurement step (only *stepping mode*)	*RUN*

Description of command	Sig. State	FW vers.
These commands have no query form. They start and stop the modulation measurement, setting it to the status indicated in the top right column.	CCH TCH	V2.80

CONFigure:MODulation:OVERview:EPSK:TCH:EREPorting <*Mode*> Event Reporting

<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
SRQ |	Service request	OFF	–	–
SOPC |	Single operation complete			
SRSQ |	SRQ and SOPC			
OFF	No reporting			

Description of command	Sig. State	FW vers.
This command defines the events generated when the measurement is terminated or stopped *(event reporting,* see chapter 5 of CMU200 manual).	all	V2.80

FETCh:MODulation:OVERview:EPSK:TCH:STATus? Measurement Status

Ret. values	Description of parameters	Def. value	Def. unit	Unit ring
OFF | **RUN |** **STOP |** **ERR |** **STEP |** **RDY,**	Measurement in the *OFF* state (`*RST` or `ABORt`) Running (after `INITiate, CONTinue` or `READ`) Stopped (`STOP`) *OFF* (could not be started) Stepping mode *(<stepmode>=STEP)* Stopped according to repetition mode and stop condition	OFF	–	
1 to 10000 | **NONE,**	Counter for current statistics cycle No counting mode set	NONE	–	
1 to 1000 | **NONE**	Counter for current evaluation period within a cycle Statistic count set to off	NONE	–	
Description of command			Sig. State	FW vers.
This command is always a query. It returns the status of the measurement (see chapters 3 and 5).			all	V2.80

Test Configuration

The commands of the following subsystems configure the *Modulation* measurement. They correspond to the sections in the *Modulation Configuration* menu that are related to the *Overview* application.

Subsystem MODulation:OVERview:EPSK:TCH:CONTrol

The subsystem *MODulation:OVERview:EPSK:TCH:CONTrol* configures the modulation measurement. It corresponds to the tabs *Control* and *Statistics* in the popup menu *Modulation Configuration*.

CONFigure:MODulation:OVERview:EPSK:TCH:CONTrol *<Mode>, <Statistics>, <Repetition>, <StopCond>, <Stepmode>* Scope of Measurement

<Mode>	Desciption of parameters	Def. value	Def. unit	Unit ring
SCALar | **ARRay,**	Scalar values only (incl. ramp matching) Scalar measured values and arrays	ARRay	–	–
<Statistics>	Description of parameters	Def. value	Def. unit	Unit ring
1 to 1000 | **NONE**	Number of bursts per statistics cycle Statistics off (equivalent to 1)	200	–	–
<Repetition>	Description of parameters	Def. value	Def. unit	Unit ring
CONTinuous | **SINGleshot |** **1 to 10000,**	Continuous measurement (until `STOP` or `ABORT`) Single shot measurement (until `Status = RDY`) Multiple measurement (*counting*, until `Status = STEP | RDY`)	SING	–	–
<StopCond>	Description of parameters	Def. value	Def. unit	Unit ring
SOERror | **NONE,**	Stop measurement in case of error *(stop on error)* Continue measurement even in case of error	NONE	–	–

<Stepmode>	Description of parameters	Def. value	Def. unit	Unit ring
STEP | **NONE**	Interrupt measurement after each statistics cycle Continue measurement according to its rep. mode	NONE	–	–
Description of command				FW-Vers.
This command defines the scope of the modulation measurement, combining the `...CONTrol:RMODe`, `...CONTrol:STATistics`, and the `...CONTrol: REPetition` commands (see below).				1.0

CONFigure:MODulation:OVERview:EPSK:TCH:CONTrol:RMODe *<Mode>* Result Mode

<Mode>	Desciption of parameters	Def. value	Def. unit	Unit ring
SCALar | **ARRay,**	Scalar values only (incl. ramp matching) Scalar measured values and arrays	ARRay	–	–
Description of command				FW-Vers.
This command specifies the type of measured values.				1.0

CONFigure:MODulation:OVERview:EPSK:TCH:CONTrol:STATistics *<Statistics>* Statistics Count

<Statistics>	Description of parameters	Def. value	Def. unit	Unit ring
1 to 1000 | **NONE**	Number of bursts per statistics cycle Statistics off (equivalent to 1)	100	–	–
Description of command				FW-Vers.
This command defines the number of bursts forming a statistics cycle.				1.0

CONFigure:MODulation:OVERview:EPSK:TCH:CONTrol:REPetition
<Repetition>* ,*<StopCond>*,*<Stepmode> Test Cycles

<Repetition>	Description of parameters	Def. value	Def. unit	Unit ring
CONTinuous | **SINGleshot |** **1 to 10000**	Continuous measurement (until `STOP` or `ABORT`) Single shot measurement (until `Status = RDY`) Multiple measurement (*counting*, until `Status = STEP | RDY`)	SING	–	
<StopCond>	Description of parameters	Def. value	Def. unit	Unit ring
SOERror | **NONE**	Stop measurement in case of error *(stop on error)* Continue measurement even in case of error	NONE	–	
<Stepmode>	Description of parameters	Def. value	Def. unit	Unit ring
STEP | **NONE**	Interrupt measurement after each statistics cycle Continue measurement according to its rep. mode	NONE	–	
Description of command			Sig. State	FW vers.
This command determines the number of statistics cycles, the stop condition and the stepping mode for the measurement. **Note:** *In the case of READ commands (`READ:...`), the <Repetition> parameter has no effect; the measurement is always stopped after a single shot.*			all	V2.80

DEFault:MODulation:OVERview:EPSK:TCH:CONTrol ***<Mode>***				Default Settings
<Enable>	Description of parameters	Def. value	Def. unit	Unit ring
ON | **OFF**	The parameters are set to their default values Some or all parameters differ from the default values	ON	–	
Description of command			Sig. State	FW vers.
If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to their default values (the setting *OFF* has no effect). If used as a query the command returns whether all parameters are set to their default values *(ON)* or not *(OFF).*			all	V2.80

Tolerance values – Subsystem MODulation:OEMP:EPSK:TCH:LIMit

The subsystem *MODulation:OEMP:EPSK:TCH:LIMit* defines tolerance values for the modulation measurement **in all four 8PSK applications**. The subsystem corresponds to the *Limits* tab in the popup menu *Modulation Configuration.*

CONFigure:MODulation:OEMP:EPSK:TCH:CMMax:LIMit[:SCALar]:SYMMetric [:COMBined]:VALue
CONFigure:MODulation:OEMP:EPSK:TCH:AVERage:LIMit[:SCALar]:SYMMetric [:COMBined]:VALue
<EVMErrorPeak>,<EVMErrorRMS>,<MagnErrorPeak>, <MagnErrorRMS>, <PhaseErrorPeak>, <PhaseErrorRMS>, <OriginOffset>, <IQImbalance>, <FreqError>
Limits Current & Max, Average

Parameter	Description of parameters	Def. value	Def. unit	Unit ring
0.0 % to +50.0 %,	EVM Error Peak	+22.0	%	
0.0 % to +50.0 %,	EVM Error RMS	+8.0	%	
0.0 % to +50.0 %,	Magn Error Peak	+22.0	%	
0.0 % to +50.0 %,	Magn Error RMS	+8.0	%	
0.0 deg to +50.0 deg,	Phase Error Peak	+180.0	deg	
0.0 deg to +50.0 deg,	Phase Error RMS	+180.0	deg	
–100.0 dB to 0.0 dB,	Origin Offset	–35.0	dB	
–100.0 dB to 0.0 dB,	IQ Imbalance	–20.0	dB	
0 Hz to 999 Hz	Frequency Error	+45	Hz	

Description of command	FW vers.
These commands define upper limits for the *Current* and *Max./Min.* traces (keyword `CMMax`) as well as for the *Average* trace (keyword `AVERage)` and for the scalar modulation parameters derived from them. The default value for the frequency error depends on the GSM band: It is 23 Hz for GSM 400, 45 Hz for GSM 900, and 90 Hz for GSM 1800 and GSM 1900.	V2.80

CONFigure:MODulation:OEMP:EPSK:TCH:P95Th:LIMit[:SCALar]:SYMMetric [:COMBined]:VALue ***<EVM95%>, <MError95%>, <PError95%>***
95th Percentile

Parameter	Description of parameters	Def. value	Def. unit	Unit ring
0% to 50.0%,	95th percentile EVM	+11.0	%	
0% to 50.0%,	95th percentile magnitude error	+11.0	%	
0° to 180°	95th percentile phase error	+11.0	deg	

Description of command	FW vers.
This command defines upper limits for the 95th percentile of the three quantities *error vector magnitude*, *magnitude error*, and *phase error*. The 95th percentile is the limit below which 95% of the measured errors are located.	V2.80

DEFault:MODulation:OEMP:EPSK:TCH:LIMit <*Mode*> Default Settings

<Enable>	Description of parameters	Def. value	Def. unit	Unit ring
ON | **OFF**	The parameters are set to their default values Some or all parameters differ from the default values	ON	–	

Description of command	Sig. State	FW vers.
If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to their default values (the setting *OFF* has no effect). If used as a query the command returns whether all parameters are set to their default values *(ON)* or not *(OFF)*.	all	V2.80

Measured Values – Subsystem MODulation:OVERview:EPSK:TCH

The subsystem *MODulation:OVERview:EPSK:TCH* measures and returns the modulation parameters and compares them with the tolerance values. The subsystem corresponds to the various output elements in the *Modulation* measurement menu, application *Overview 8PSK*.

READ[:SCALar]:MODulation:OVERview:EPSK:TCH? Scalar Results:
Start single shot measurement and return results
FETCh[:SCALar]:MODulation:OVERview:EPSK:TCH?
Read out meas. results (unsynchronized)
SAMPle[:SCALar]:MODulation:OVERview:EPSK:TCH?
Read out measurement results (synchronized)

Returned values	Value range	Def. value	Def. unit	Unit ring
95thPercentileEVM,	0.0 % to 100.0 %	NAN	%	
95thPercentileMagErr,	0.0 % to 100.0 %	NAN	%	
95thPercentilePhErr,	–100.0 deg to +100.0 deg	NAN	deg	
EVMPeak (x3),	0.0 % to 100.0 %	NAN	%	
EVMRMS (x3),	0.0 % to 100.0 %	NAN	%	
MagnErrorPeak (x3),	0.0 % to 100.0 %	NAN	%	
MagnErrorRMS (x3),	0.0 % to 100.0 %	NAN	%	
PhErrorPeak(x3),	–100.0 deg to +100.0 deg	NAN	deg	
PhErrorRMS (x3),	–100.0 deg to +100.0 deg	NAN	deg	
OriginOffset (x3),	–100.0 dB to +100.0 dB	NAN	dB	
IQImbalance (x3),	–100.0 dB to +100.0 dB	NAN	dB	
FrequencyError (x3),	–1000.0 Hz to +1000.0 Hz	NAN	Hz	
AvgBurstPowerCurr,	–100.0 dBm to +20.0 dBm	NAN	dBm	
BurstsOutOfTol	0.0 % to 100.0 %	NAN	%	

Description of command	Sig. State	FW vers.
These commands are always queries. They start a modulation measurement and output all scalar measurement results (see chapter 4). The calculation of results in an *average* or *peak* measurement is described in chapter 3 (see *calculation of statistical quantities*). The symbol (x3) behind a value indicates that the list contains three results corresponding to the *Current*, the *Average,* and the *MMax* value.	CCH TCH	V2.80

CALCulate[:SCALar]:MODulation:OVERview:EPSK:TCH:MATChing:LIMit?

Bursts out of Tolerance

Returned values	Value range	Def. value	Def. unit	Unit ring
95thPercentileEVM,		INV	–	
95thPercentileMagErr,		INV	–	
95thPercentilePhErr,		INV	–	
EVMPeak (x3),	**For all measured values:**	INV	–	
EVMRMS (x3),		INV	–	
MagnErrorPeak (x3),		INV	–	
MagnErrorRMS (x3),		INV	–	
PhErrorPeak(x3),	**NMAU |NMAL | INV | OK**	INV	–	
PhErrorRMS (x3),		INV	–	
OriginOffset (x3),		INV	–	
IQImbalance (x3),		INV	–	
FrequencyError (x3),		INV	–	
AvgBurstPowerCurr		INV	–	

Description of command	Sig. State	FW vers.
This command is always a query. It indicates whether and in which way the error limits for the scalar measured values (see above command) have been exceeded. The symbol (x3) behind a value indicates that the list contains three results corresponding to the *Current*, the *Average,* and the *MMax* value. The following messages may be output for all measured values: NMAU Underflow of tolerance value *not matching, underflow* NMAL Tolerance value exceeded *not matching, overflow* INV Measurement invalid *invalid* OK all tolerances matched	CCH TCH	V2.80

Test Object MODulation:EVMagnitude

The subsystem *MODulation:EVMagnitude* measures the error vector magnitude as well as general scalar modulation parameters. The subsystem corresponds to the measurement menu *Modulation*, application *Error Vect. Magn. 8PSK*, and the associated popup menu *Modulation Configuration.*

Important Note!

The keyword `:EPSK:TCH` *in the remote control commands of this section denotes 8PSK modulation (TCH test). The commands are available with option CMU-K41 only.*

Control of Measurement – Subsystem MODulation:EVMagnitude

The subsystem *MODulation:EVMagnitude* controls the modulation measurement. It corresponds to the softkey *EVM 8PSK* in the measurement menu *Modulation*.

INITiate:MODulation:EVMagnitude:EPSK:TCH	Start new measurement	*RUN*
ABORt:MODulation:EVMagnitude:EPSK:TCH	Abort running measurement and switch off	*OFF*
STOP:MODulation:EVMagnitude:EPSK:TCH	Stop measurement after current stat. cycle	*STOP*
CONTinue:MODulation:EVMagnitude:EPSK:TCH	Next meas. step (only *stepping mode*)	*RUN*

Description of command	Sig. State	FW vers.
These commands have no query form. They start and stop the modulation measurement, setting it to the status indicated in the top right column.	CCH TCH	V2.80

CONFigure:MODulation:EVMagnitude:EPSK:TCH:EREPorting <*Mode*> Event Reporting

<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
SRQ |	Service request	OFF	–	
SOPC |	Single operation complete			
SRSQ |	SRQ and SOPC			
OFF	No reporting			

Description of command	Sig. State	FW vers.
This command defines the events generated when the measurement is terminated or stopped *(event reporting*, see chapter 5 of CMU200 manual).	all	V2.80

FETCh:MODulation:EVMagnitude:EPSK:TCH:STATus? Measurement Status

Ret. values	Description of parameters	Def. value	Def. unit	Unit ring
OFF | **RUN |** **STOP |** **ERR |** **STEP |** **RDY,**	Measurement in the *OFF* state (`*RST` or `ABORt`) Running (after `INITiate, CONTinue` or `READ`) Stopped (`STOP`) *OFF* (could not be started) Stepping mode *(<stepmode>=STEP)* Stopped according to repetition mode and stop condition	OFF	–	
1 to 10000 | **NONE,**	Counter for current statistics cycle No counting mode set	NONE	–	
1 to 1000 | **NONE**	Counter for current evaluation period within a cycle Statistic count set to off	NONE	–	

Description of command	Sig. State	FW vers.
This command is always a query. It returns the status of the measurement (see chapters 3 and 5).	all	V2.80

Test Configuration

The commands of the following subsystems configure the *Modulation* measurement. They correspond to the sections in the *Modulation Configuration* menu that are related to the *Error Vector Magnitude* application.

Subsystem MODulation:EVMagnitude:EPSK:TCH:CONTrol

The subsystem *MODulation:EVMagnitude:EPSK:TCH:CONTrol* configures the modulation measurement. It corresponds to the tabs *Control* and *Statistics* in the popup menu *Modulation Configuration.*

CONFigure:MODulation:EVMagnitude:EPSK:TCH:CONTrol *<Mode>, <Statistics>, <Repetition>, <StopCond>, <Stepmode>* Scope of Measurement

<Mode>	Desciption of parameters	Def. value	Def. unit	Unit ring
SCALar | **ARRay,**	Scalar values only (incl. ramp matching) Scalar measured values and arrays	ARRay	–	–
<Statistics>	Description of parameters	Def. value	Def. unit	Unit ring
1 to 1000 | **NONE**	Number of bursts per statistics cycle Statistics off (equivalent to 1)	100	–	–
<Repetition>	Description of parameters	Def. value	Def. unit	Unit ring
CONTinuous | **SINGleshot |** **1 to 10000,**	Continuous measurement (until `STOP` or `ABORT`) Single shot measurement (until `Status = RDY`) Multiple measurement (*counting*, until `Status = STEP | RDY`)	SING	–	–
<StopCond>	Description of parameters	Def. value	Def. unit	Unit ring
SOERror | **NONE,**	Stop measurement in case of error *(stop on error)* Continue measurement even in case of error	NONE	–	–

<Stepmode>	Description of parameters	Def. value	Def. unit	Unit ring
STEP | **NONE**	Interrupt measurement after each statistics cycle Continue measurement according to its rep. mode	NONE	–	–

Description of command	FW-Vers.
This command defines the scope of the modulation measurement, combining the `...CONTrol:RMODe`, `...CONTrol:STATistics`, and the `...CONTrol: REPetition` commands (see below).	1.0

CONFigure:MODulation:EVMagnitude:EPSK:TCH:CONTrol:RMODe *<Mode>* Result Mode

<Mode>	Desciption of parameters	Def. value	Def. unit	Unit ring
SCALar | **ARRay,**	Scalar values only (incl. ramp matching) Scalar measured values and arrays	ARRay	–	–

Description of command	FW-Vers.
This command specifies the type of measured values.	1.0

CONFigure:MODulation:EVMagnitude:EPSK:TCH:CONTrol:STATistics *<Statistics>* Statistics Count

<Statistics>	Description of parameters	Def. value	Def. unit	Unit ring
1 to 1000 | **NONE**	Number of bursts per statistics cycle Statistics off (equivalent to 1)	100	–	–

Description of command	FW-Vers.
This command defines the number of bursts forming a statistics cycle.	1.0

CONFigure:MODulation:EVMagnitude:EPSK:TCH:CONTrol:REPetition *<Repetition>* ,*<StopCond>*,*<Stepmode>* Test Cycles

<Repetition>	Description of parameters	Def. value	Def. unit	Unit ring
CONTinuous | **SINGleshot |** **1 to 10000**	Continuous measurement (until `STOP` or `ABORT`) Single shot measurement (until `Status = RDY`) Multiple measurement (*counting*, until `Status = STEP | RDY`)	SING	–	
<StopCond>	Description of parameters	Def. value	Def. unit	Unit ring
SOERror | **NONE**	Stop measurement in case of error *(stop on error)* Continue measurement even in case of error	NONE	–	
<Stepmode>	Description of parameters	Def. value	Def. unit	Unit ring
STEP | **NONE**	Interrupt measurement after each statistics cycle Continue measurement according to its rep. mode	NONE	–	

Description of command	Sig. State	FW vers.
This command determines the number of statistics cycles, the stop condition and the stepping mode for the measurement. **Note:** *In the case of READ commands (`READ:...`), the <Repetition> parameter has no effect; the measurement is always stopped after a single shot.*	all	V2.80

DEFault:MODulation:EVMagnitude:EPSK:TCH:CONTrol *<Mode>*				Default Settings
<Enable>	Description of parameters	Def. value	Def. unit	Unit ring
ON | **OFF**	The parameters are set to their default values Some or all parameters differ from the default values	ON	–	
Description of command			Sig. State	FW vers.
If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to their default values (the setting *OFF* has no effect). If used as a query the command returns whether all parameters are set to their default values *(ON)* or not *(OFF)*.			all	V2.80

Tolerance values – Subsystem MODulation:OEMP:EPSK:TCH:LIMit

The subsystem *MODulation:OEMP:EPSK:TCH:LIMit* (see p. 6.123 ff) defines tolerance values for the modulation measurement **in all four EPSK applications**. The subsystem corresponds to the *Limits* tab in the popup menu *Modulation Configuration.*

Subsystem SUBarrays:MODulation

The subsystem *SUBarrays:MODulation* defines the measurement range and the type of output values.

CONFigure:SUBarrays:MODulation:EVMagnitude:EPSK:TCH <Mode>,<Start>,<Samples>{,<Start>,<Samples>}				Definition of Subarrays
<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
ALL | **ARIThmetical |** **MINimum |** **MAXimum,**	Return all measurement values Return arithm. mean value in every range Return minimum value in every range Return maximum value in every range	ALL	–	
<Start>	Description of parameters	Def. value	Def. unit	Unit ring
3 symb to 144 symb,	Start time in current range	0	symb	
<Samples>	Description of parameters	Def. value	Def. unit	Unit ring
0 to 142	Number of samples in current range	142	–	
Description of command			Sig. State	FW vers.
This command configures the `READ:SUBarrays...`, `FETCh:SUBarrays...`, and `SAMPle:SUBarrays:MODulation:EVMagnitude:EPSK:TCH` commands. It restricts the measurement to up to 32 subranges where either all measurement results (the number of which is given by the second numerical parameter) or a single statistical value is returned. The subranges are defined by the start time and the number of test points which are located on a fixed, equidistant grid with a step width of 1 symb. The subranges may overlap but must be within the total range of the *Modulation* measurement. Test points outside this range are not measured (result *NAN)* and do not enter into the ARIThmetical, MINimum and MAXimum values. By default, only one range corresponding to the total measurement range is used and all measurement values are returned.			all	V2.80

Measured Values – Subsystem MODulation:EVMagnitude:EPSK:TCH

The subsystem *MODulation:EVMagnitude:EPSK:TCH* measures and returns the modulation parameters and compares them with the tolerance values. The subsystem corresponds to the various output elements in the measurement menu *MODulation*, application *EVM 8PSK.*

READ[:SCALar]:MODulation:EVMagnitude:EPSK:TCH Scalar Results: Start single shot measurement and return results

FETCh[:SCALar]:MODulation:EVMagnitude:EPSK:TCH Read out meas. results (unsynchronized)

SAMPle[:SCALar]:MODulation:EVMagnitude:EPSK:TCH Read out measurement results (synchronized)

Returned values	Value range	Def. value	Def. unit	Unit ring
95thPercentileEVM	0.0 % to 100.0 %	NAN	%	
EVMPeak (x3),	0.0 % to 100.0 %	NAN	%	
EVMRMS (x3),	0.0 % to 100.0 %	NAN	%	
OriginOffset (x3),	–100.0 dB to +100.0 dB	NAN	dB	
IQImbalance (x3),	–100.0 dB to +100.0 dB	NAN	dB	
FrequencyError (x3),	–1000.0 Hz to +1000.0 Hz	NAN	Hz	
AvgBurstPowerCurr,	–100.0 dBm to +20.0 dBm	NAN	dBm	
AvgBurstPowerAvg	–100.0 dBm to +20.0 dBm	NAN	dBm	
BurstsOutOfTol	0.0 % to 100.0 %	NAN	%	

Description of command	Sig. State	FW vers.
These commands are always queries. They start a modulation measurement and output all scalar measurement results (see chapter 4). The calculation of results in an *average* or *peak* measurement is described in chapter 3 (see *calculation of statistical quantities*). The symbol (x3) behind a value indicates that the list contains three results corresponding to the *Current*, the *Average*, and the *MMax* value.	CCH TCH	V2.80

CALCulate[:SCALar]:MODulation:EVMagnitude:EPSK:TCH:MATChing:LIMit? Bursts out of Tolerance

Returned values	Value range	Def. value	Def. unit	Unit ring
95thPercentileEVM		INV	–	
PhErrorPeak (x3),		INV	–	
PhErrorRMS (x3),	**For all measured values:**	INV	–	
		INV	–	
OriginOffset (x3),	**NMAU |NMAL | INV | OK**			
IQImbalance (x3),		INV	–	
FrequencyError(x3)		INV	–	

Description of command	Sig. State	FW vers.
This command is always a query. It indicates whether and in which way the error limits for the scalar measured values (see above command) have been exceeded. The symbol (x3) behind a value indicates that the list contains three results corresponding to the *Current*, the *Average*, and the *MMax* value. The limits are defined with the `CONFigure:MODulation:OEMP...` commands.	CCH TCH	V2.80

The following messages may be output for all measured values:

NMAU	Underflow of tolerance value	*not matching, underflow*
NMAL	Tolerance value exceeded	*not matching, overflow*
INV	Measurement invalid	*invalid*
OK	all tolerances matched	

READ:ARRay:MODulation:EVMagnitude:EPSK:TCH:CURRent? Phase Error in Burst
READ:ARRay:MODulation:EVMagnitude:EPSK:TCH:AVERage?
READ:ARRay:MODulation:EVMagnitude:EPSK:TCH:MMAXimum?
Start single shot measurement and return results *RUN*
FETCh:ARRay:MODulation:EVMagnitude:EPSK:TCH:CURRent?
FETCh:ARRay:MODulation:EVMagnitude:EPSK:TCH:AVERage?
FETCh:ARRay:MODulation:EVMagnitude:EPSK:TCH:MMAXimum?
Read measurement results (unsynchronized) *RUN*
SAMPle:ARRay:MODulation:EVMagnitude:EPSK:TCH:CURRent?
SAMPle:ARRay:MODulation:EVMagnitude:EPSK:TCH:AVERage?
SAMPle:ARRay:MODulation:EVMagnitude:EPSK:TCH:MMAXimum?
Read measurement results (synchronized) *RUN*

Returned values	Description of parameters	Def. value	Def. unit	Unit ring
0.0 % to+ 100.0 %,	1^{st} value for error vector magnitude	NAN	%	
... ,	...	...	...	
0.0 % to+ 100.0 %	142th value for error vector magnitude	NAN	%	

Description of command	Sig. State	FW vers.
These commands are always queries. They return the error vector magnitude vs. time at fixed, equidistant test points. The number of measured values is 142, corresponding to a time range of 3 symb to 144 symb.	all	V2.80

The calculation of *Current, Average, and MMax* (Min./Max.) results is explained in chapter 3 (see *display mode*).

READ:SUBarrays:MODulation:EVMagnitude:EPSK:TCH:CURRent? Subarray Results
READ:SUBarrays:MODulation:EVMagnitude:EPSK:TCH:AVERage?
READ:SUBarrays:MODulation:EVMagnitude:EPSK:TCH:MMAXimum?
Start single shot measurement and return results *RUN*

FETCh:SUBarrays:MODulation:EVMagnitude:EPSK:TCH:CURRent?
FETCh:SUBarrays:MODulation:EVMagnitude:EPSK:TCH:AVERage?
FETCh:SUBarrays:MODulation:EVMagnitude:EPSK:TCH:MMAXimum?
Read meas. results (unsynchronized) *RUN*

SAMPle:SUBarrays:MODulation:EVMagnitude:EPSK:TCH:CURRent?
SAMPle:SUBarrays:MODulation:EVMagnitude:EPSK:TCH:AVERage?
SAMPle:SUBarrays:MODulation:EVMagnitude:EPSK:TCH:MMAXimum?
Read results (synchronized) *RUN*

Ret. values per subrange	Description of parameters	Def. value	Def. unit	Unit ring
0.0 % to + 100.0 %,	1st value for error vector magnitude	NAN	%	
... ,	...	...	...	
0.0 % to + 100.0 %	nth value for error vector magnitude	NAN	%	

Description of command	Sig. State	FW vers.
These commands are always queries. They measure and return the error vector magnitude versus time in the subranges defined by means of the `CONFigure:SUBarrays:MODulation:EVMagnitude:EPSK:TCH` command. In the default setting of the configuration command the `READ:SUBarrays...`, `FETCh:SUBarrays...`, and `SAMPle:SUBarrays...` command group is equivalent to the `READ:ARRay...`, `FETCh:ARRay...`, and `SAMPle:ARRay...` command group described above. The `CONFigure:SUBarrays:MODulation:EVMagnitude:EPSK:TCH` command defines a maximum of 32 subranges. If one of the statistical modes `(ARIThmetical, MINimum, MAXimum)` is set, only one value is returned per subrange. The calculation of *current*, *average*, *minimum*, and *maximum* results is explained in chapter 3 (see *display mode*).	CCH TCH	V2.80

Test Object MODulation:PERRor:EPSK:TCH

The subsystem *MODulation:PERRor* measures the phase error as well as general scalar modulation parameters. The subsystem corresponds to the measurement menu *Modulation*, application *Phase Error 8PSK*, and the associated popup menu *Modulation Configuration*.

Important Note!

The keyword `:EPSK:TCH` in the remote control commands of this section denotes 8PSK modulation (TCH test). The commands are available with option CMU-K41 only.

Control of Measurement – Subsystem MODulation:PERRor

The subsystem *MODulation:PERRor* controls the modulation measurement. It corresponds to the softkey *Phase Error 8PSK* in the measurement menu *Modulation*.

INITiate:MODulation:PERRor:EPSK:TCH	Start new measurement	*RUN*
ABORt:MODulation:PERRor:EPSK:TCH	Abort running measurement and switch off	*OFF*
STOP:MODulation:PERRor:EPSK:TCH	Stop measurement after current stat. cycle	*STOP*
CONTinue:MODulation:PERRor:EPSK:TCH	Next measurement step (only *stepping mode*)	*RUN*

Description of command	Sig. State	FW vers.
These commands have no query form. They start and stop the modulation measurement, setting it to the status indicated in the top right column.	CCH TCH	V2.80

CONFigure:MODulation:PERRor:EPSK:TCH:EREPorting <*Mode*> Event Reporting

<*Mode*>	Description of parameters	Def. value	Def. unit	Unit ring
SRQ |	Service request	OFF	–	
SOPC |	Single operation complete			
SRSQ |	SRQ and SOPC			
OFF	No reporting			

Description of command	Sig. State	FW vers.
This command defines the events generated when the measurement is terminated or stopped *(event reporting*, see chapter 5 of CMU200 manual).	all	V2.80

FETCh:MODulation:PERRor:EPSK:TCH:STATus? Measurement Status

Ret. values	Description of parameters	Def. value	Def. unit	Unit ring
OFF | **RUN |** **STOP |** **ERR |** **STEP |** **RDY,**	Measurement in the *OFF* state (`*RST` or `ABORt`) Running (after `INITiate, CONTinue` or `READ`) Stopped (`STOP`) *OFF* (could not be started) Stepping mode *(<stepmode>=STEP)* Stopped according to repetition mode and stop condition	OFF	–	
1 to 10000 | **NONE,**	Counter for current statistics cycle No counting mode set	NONE	–	
1 to 1000 | **NONE**	Counter for current evaluation period within a cycle Statistic count set to off	NONE	–	

Description of command	Sig. State	FW vers.
This command is always a query. It returns the status of the measurement (see chapters 3 and 5).	all	V2.80

Test Configuration

The commands of the following subsystems configure the *Modulation* measurement. They correspond to the sections in the *Modulation Configuration* menu that are related to the *Magnitude Error* application.

Subsystem MODulation:PERRor:EPSK:TCH:CONTrol

The subsystem *MODulation:PERRor:EPSK:TCH:CONTrol* configures the modulation measurement. It corresponds to the tabs *Control* and *Statistics* in the popup menu *Modulation Configuration.*

CONFigure:MODulation:PERRor:EPSK:TCH:CONTrol *<Mode>, <Statistics>, <Repetition>, <StopCond>, <Stepmode>* Scope of Measurement

<Mode>	Descpition of parameters	Def. value	Def. unit	Unit ring
SCALar | **ARRay,**	Scalar values only (incl. ramp matching) Scalar measured values and arrays	ARRay	–	–
<Statistics>	**Description of parameters**	**Def. value**	**Def. unit**	**Unit ring**
1 to 1000 | **NONE**	Number of bursts per statistics cycle Statistics off (equivalent to 1)	100	–	–
<Repetition>	**Description of parameters**	**Def. value**	**Def. unit**	**Unit ring**
CONTinuous | **SINGleshot |** **1 to 10000,**	Continuous measurement (until `STOP` or `ABORT`) Single shot measurement (until `Status = RDY`) Multiple measurement (*counting*, until `Status = STEP | RDY`)	SING	–	–
<StopCond>	**Description of parameters**	**Def. value**	**Def. unit**	**Unit ring**
SOERror | **NONE,**	Stop measurement in case of error *(stop on error)* Continue measurement even in case of error	NONE	–	–

<Stepmode>	Description of parameters	Def. value	Def. unit	Unit ring
STEP | **NONE**	Interrupt measurement after each statistics cycle Continue measurement according to its rep. mode	NONE	–	–

Description of command	FW-Vers.
This command defines the scope of the modulation measurement, combining the `...CONTrol:RMODe`, `...CONTrol:STATistics`, and the `...CONTrol: REPetition` commands (see below).	1.0

CONFigure:MODulation:PERRor:EPSK:TCH:CONTrol:RMODe *<Mode>* Result Mode

<Mode>	Desciption of parameters	Def. value	Def. unit	Unit ring
SCALar | **ARRay,**	Scalar values only (incl. ramp matching) Scalar measured values and arrays	ARRay	–	–

Description of command	FW-Vers.
This command specifies the type of measured values.	1.0

CONFigure:MODulation:PERRor:EPSK:TCH:CONTrol:STATistics *<Statistics>* Statistics Count

<Statistics>	Description of parameters	Def. value	Def. unit	Unit ring
1 to 1000 | **NONE**	Number of bursts per statistics cycle Statistics off (equivalent to 1)	100	–	–

Description of command	FW-Vers.
This command defines the number of bursts forming a statistics cycle.	1.0

CONFigure:MODulation:PERRor:EPSK:TCH:CONTrol:REPetition *<Repetition> ,<StopCond>,<Stepmode>* Test Cycles

<Repetition>	Description of parameters	Def. value	Def. unit	Unit ring
CONTinuous | **SINGleshot |** **1 to 10000**	Continuous measurement (until `STOP` or `ABORT`) Single shot measurement (until `Status = RDY`) Multiple measurement (*counting*, until `Status = STEP | RDY`)	SING	–	
<StopCond>	Description of parameters	Def. value	Def. unit	Unit ring
SOERror | **NONE**	Stop measurement in case of error *(stop on error)* Continue measurement even in case of error	NONE	–	
<Stepmode>	Description of parameters	Def. value	Def. unit	Unit ring
STEP | **NONE**	Interrupt measurement after each statistics cycle Continue measurement according to its rep. mode	NONE	–	

Description of command	Sig. State	FW vers.
This command determines the number of statistics cycles, the stop condition and the stepping mode for the measurement. **Note:** *In the case of READ commands (`READ:...`), the <Repetition> parameter has no effect; the measurement is always stopped after a single shot.*	all	V2.80

DEFault:MODulation:PERRor:EPSK:TCH:CONTrol *<Mode>*				Default Settings
<Enable>	Description of parameters	Def. value	Def. unit	Unit ring
ON | **OFF**	The parameters are set to their default values Some or all parameters differ from the default values	ON	–	
Description of command			Sig. State	FW vers.
If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to their default values (the setting *OFF* has no effect). If used as a query the command returns whether all parameters are set to their default values *(ON)* or not *(OFF)*.			all	V2.80

Tolerance values – Subsystem MODulation:OEMP:EPSK:TCH:LIMit

The subsystem *MODulation:OEMP:EPSK:TCH:LIMit* (see p. 6.123 ff) defines tolerance values for the modulation measurement **in all four EPSK applications**. The subsystem corresponds to the *Limits* tab in the popup menu *Modulation Configuration*.

Subsystem SUBarrays:MODulation:PERRor:EPSK:TCH

The subsystem *SUBarrays:MODulation* defines the measurement range and the type of output values.

CONFigure:SUBarrays:MODulation:PERRor:EPSK:TCH <Mode>,<Start>,<Samples>{,<Start>,<Samples>}				Definition of Subarrays
<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
ALL | **ARIThmetical |** **MINimum |** **MAXimum,**	Return all measurement values Return arithm. mean value in every range Return minimum value in every range Return maximum value in every range	ALL	–	
<Start>	Description of parameters	Def. value	Def. unit	Unit ring
3 symb to 144 symb,	Start time in current range	0	symb	
<Samples>	Description of parameters	Def. value	Def. unit	Unit ring
0 to 142	Number of samples in current range	142	–	

Description of command	Sig. State	FW vers.
This command configures the `READ:SUBarrays...`, `FETCh:SUBarrays...`, and `SAMPle:SUBarrays:MODulation:PERRor:EPSK:TCH` commands. It restricts the measurement to up to 32 subranges where either all measurement results (the number of which is given by the second numerical parameter) or a single statistical value is returned. The subranges are defined by the start time and the number of test points which are located on a fixed, equidistant grid with a step width of 1 symb. The subranges may overlap but must be within the total range of the *Modulation* measurement. Test points outside this range are not measured (result *NAN)* and do not enter into the ARIThmetical, MINimum and MAXimum values. By default, only one range corresponding to the total measurement range is used and all measurement values are returned.	all	V2.80

Measured Values – Subsystem MODulation:PERRor:EPSK:TCH

The subsystem *MODulation:PERRor:EPSK:TCH* measures and returns the modulation parameters and compares them with the tolerance values. The subsystem corresponds to the various output elements in the measurement menu *MODulation,* application *Phase Error 8PSK.*

READ[:SCALar]:MODulation:PERRor:EPSK:TCH? Scalar Results:
Start single shot measurement and return results

FETCh[:SCALar]:MODulation:PERRor:EPSK:TCH?
Read out meas. results (unsynchronized)

SAMPle[:SCALar]:MODulation:PERRor:EPSK:TCH?
Read out measurement results (synchronized)

Returned values	Value range	Def. value	Def. unit	Unit ring
95thPercentilePhError	0.0 deg to 50.0 deg	NAN	deg	
EVMPeak (x3),	0.0 % to 100.0 %	NAN	%	
EVMRMS (x3),	0.0 % to 100.0 %	NAN	%	
OriginOffset (x3),	–100.0 dB to +100.0 dB	NAN	dB	
IQImbalance (x3),	–100.0 dB to +100.0 dB	NAN	dB	
FrequencyError (x3),	–1000.0 Hz to +1000.0 Hz	NAN	Hz	
AvgBurstPowerCurr,	–100.0 dBm to +20.0 dBm	NAN	dBm	
AvgBurstPowerAvg	–100.0 dBm to +20.0 dBm	NAN	dBm	
BurstsOutOfTol	0.0 % to 100.0 %	NAN	%	

Description of command	Sig. State	FW vers.
These commands are always queries. They start a modulation measurement and output all scalar measurement results (see chapter 4), either for the whole burst or for the 1st ten valid symbols in the burst. The calculation of results in an *average* or *peak* measurement is described in chapter 3 (see *calculation of statistical quantities*). The symbol (x3) behind a value indicates that the list contains three results corresponding to the *Current*, the *Average,* and the *MMax* value.	CCH TCH	V2.80

CALCulate[:SCALar]:MODulation:PERRor:EPSK:TCH:MATChing:LIMit?

Bursts out of Tolerance

Returned values	Value range	Def. value	Def. unit	Unit ring
95thPercentilePhError		INV	–	
PhErrorPeak (x3),		INV	–	
PhErrorRMS (x3),	**For all measured values:**	INV	–	
		INV	–	
OriginOffset (x3),	**NMAU |NMAL | INV | OK**			
IQImbalance (x3),		INV	–	
FrequencyError(x3)		INV	–	

Description of command	Sig. State	FW vers.
This command is always a query. It indicates whether and in which way the error limits for the scalar measured values (see above command) have been exceeded. The symbol (x3) behind a value indicates that the list contains three results corresponding to the *Current*, the *Average*, and the *MMax* value. The limits are defined with the `CONFigure:MODulation:OEMP`... commands.	CCH TCH	V2.80

The following messages may be output for all measured values:

NMAU	Underflow of tolerance value	*not matching, underflow*
NMAL	Tolerance value exceeded	*not matching, overflow*
INV	Measurement invalid	*invalid*
OK	all tolerances matched	

READ:ARRay:MODulation:PERRor:EPSK:TCH:CURRent?
READ:ARRay:MODulation:PERRor:EPSK:TCH:AVERage?
READ:ARRay:MODulation:PERRor:EPSK:TCH:MMAXimum?

Phase Error in Burst

Start single shot measurement and return results *RUN*

FETCh:ARRay:MODulation:PERRor:EPSK:TCH:CURRent?
FETCh:ARRay:MODulation:PERRor:EPSK:TCH:AVERage?
FETCh:ARRay:MODulation:PERRor:EPSK:TCH:MMAXimum?

Read measurement results (unsynchronized) *RUN*

SAMPle:ARRay:MODulation:PERRor:EPSK:TCH:CURRent?
SAMPle:ARRay:MODulation:PERRor:EPSK:TCH:AVERage?
SAMPle:ARRay:MODulation:PERRor:EPSK:TCH:MMAXimum?

Read measurement results (synchronized) *RUN*

Returned values	Description of parameters	Def. value	Def. unit	Unit ring
–100.0 deg to +100.0 deg,	1st value for phase error	NAN	deg	
... ,	...	...	...	
–100.0 deg to +100.0 deg	142th value for phase error	NAN	deg	

Description of command	Sig. State	FW vers.
These commands are always queries. They return the the phase error vs. time at fixed, equidistant test points. The number of measured values is 142, corresponding to a time range of 3 symb to 144 symb. The calculation of *current, average, and mmax* (Min./Max.) results is explained in chapter 3 (see *display mode*).	all	V2.80

READ:SUBarrays:MODulation:PERRor:EPSK:TCH:CURRent? Subarray Results
READ:SUBarrays:MODulation:PERRor:EPSK:TCH:AVERage?
READ:SUBarrays:MODulation:PERRor:EPSK:TCH:MMAXimum?
Start single shot measurement and return results *RUN*
FETCh:SUBarrays:MODulation:PERRor:EPSK:TCH:CURRent?
FETCh:SUBarrays:MODulation:PERRor:EPSK:TCH:AVERage?
FETCh:SUBarrays:MODulation:PERRor:EPSK:TCH:MMAXimum?
Read meas. results (unsynchronized) *RUN*
SAMPle:SUBarrays:MODulation:PERRor:EPSK:TCH:CURRent?
SAMPle:SUBarrays:MODulation:PERRor:EPSK:TCH:AVERage?
SAMPle:SUBarrays:MODulation:PERRor:EPSK:TCH:MMAXimum?
Read results (synchronized) *RUN*

Ret. values per subrange	Description of parameters	Def. value	Def. unit	Unit ring
100.0 deg to +100.0 deg,	1st value for phase error	NAN	deg	
... ,	...	...	...	
–100.0 deg to +100.0 deg	nth value for phase error	NAN	deg	

Description of command	Sig. State	FW vers.
These commands are always queries. They measure and return the phase error versus time in the subranges defined by means of the `CONFigure:SUBarrays:MODulation:PERRor:EPSK:TCH` command. In the default setting of the configuration command the `READ:SUBarrays...`, `FETCh:SUBarrays...`, and `SAMPle:SUBarrays...` command group is equivalent to the `READ:ARRay...`, `FETCh:ARRay...`, and `SAMPle:ARRay...` command group described above. The `CONFigure:SUBarrays:MODulation:PERRor:EPSK:TCH` command defines a maximum of 32 subranges. If one of the statistical modes `(ARIThmetical, MINimum, MAXimum)` is set, only one value is returned per subrange. The calculation of *current, average, minimum,* and *maximum* results is explained in chapter 3 (see *display mode*).	CCH TCH	V2.80

Test Object MODulation:MERRor

The subsystem *MODulation:MERRor* measures the magnitude error as well as general scalar modulation parameters. The subsystem corresponds to the measurement menu *Modulation,* application *Magn. Error 8PSK,* and the associated popup menu *Modulation Configuration.*

Important Note!

> *The keyword `:EPSK:TCH` in the remote control commands of this section denotes 8PSK modulation (TCH test). The commands are available with option CMU-K41 only.*

Control of Measurement – Subsystem MODulation:MERRor

The subsystem *MODulation:MERRor* controls the modulation measurement. It corresponds to the softkey *Magn. Error 8PSK* in the measurement menu *Modulation*.

INITiate:MODulation:MERRor:EPSK:TCH	Start new measurement	*RUN*
ABORt:MODulation:MERRor:EPSK:TCH	Abort running measurement and switch off	*OFF*
STOP:MODulation:MERRor:EPSK:TCH	Stop measurement after current stat. cycle	*STOP*
CONTinue:MODulation:MERRor:EPSK:TCH	Next measurement step (only *stepping mode*)	*RUN*

Description of command	Sig. State	FW vers.
These commands have no query form. They start and stop the modulation measurement, setting it to the status indicated in the top right column.	CCH TCH	V2.80

CONFigure:MODulation:MERRor:EPSK:TCH:EREPorting *<Mode>* Event Reporting

<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
SRQ |	Service request	OFF	–	
SOPC |	Single operation complete			
SRSQ |	SRQ and SOPC			
OFF	No reporting			

Description of command	Sig. State	FW vers.
This command defines the events generated when the measurement is terminated or stopped *(event reporting*, see chapter 5 of CMU200 manual).	all	V2.80

FETCh:MODulation:MERRor:EPSK:TCH:STATus?		Measurement Status		
Ret. values	Description of parameters	Def. value	Def. unit	Unit ring
OFF | **RUN |** **STOP |** **ERR |** **STEP |** **RDY,**	Measurement in the *OFF* state (`*RST` or `ABORt`) Running (after `INITiate, CONTinue` or `READ`) Stopped (`STOP`) *OFF* (could not be started) Stepping mode *(<stepmode>=STEP)* Stopped according to repetition mode and stop condition	OFF	–	
1 to 10000 | **NONE,**	Counter for current statistics cycle No counting mode set	NONE	–	
1 to 1000 | **NONE**	Counter for current evaluation period within a cycle Statistic count set to off	NONE	–	
Description of command			Sig. State	FW vers.
This command is always a query. It returns the status of the measurement (see chapters 3 and 5).			all	V2.80

Subsystem MODulation:MERRor:EPSK:TCH:CONTrol

The subsystem *MODulation:MERRor:EPSK:TCH:CONTrol* configures the modulation measurement. It corresponds to the tabs *Control* and *Statistics* in the popup menu *Modulation Configuration.*

CONFigure:MODulation:MERRor:EPSK:TCH:CONTrol *<Mode>, <Statistics>, <Repetition>, <StopCond>, <Stepmode>*		Scope of Measurement		
<Mode>	Desciption of parameters	Def. value	Def. unit	Unit ring
SCALar | **ARRay,**	Scalar values only (incl. ramp matching) Scalar measured values and arrays	ARRay	–	–
<Statistics>	Description of parameters	Def. value	Def. unit	Unit ring
1 to 1000 | **NONE**	Number of bursts per statistics cycle Statistics off (equivalent to 1)	100	–	–
<Repetition>	Description of parameters	Def. value	Def. unit	Unit ring
CONTinuous | **SINGleshot |** **1 to 10000,**	Continuous measurement (until `STOP` or `ABORT`) Single shot measurement (until `Status = RDY`) Multiple measurement (*counting*, until `Status = STEP | RDY`)	SING	–	–
<StopCond>	Description of parameters	Def. value	Def. unit	Unit ring
SOERror | **NONE,**	Stop measurement in case of error *(stop on error)* Continue measurement even in case of error	NONE	–	–
<Stepmode>	Description of parameters	Def. value	Def. unit	Unit ring
STEP | **NONE**	Interrupt measurement after each statistics cycle Continue measurement according to its rep. mode	NONE	–	–
Description of command				FW-Vers.
This command defines the scope of the modulation measurement, combining the `...CONTrol:RMODe, ...CONTrol:STATistics`, and the `...CONTrol: REPetition` commands (see below).				1.0

CONFigure:MODulation:MERRor:EPSK:TCH:CONTrol:RMODe *<Mode>* Result Mode

<Mode>	Desciption of parameters	Def. value	Def. unit	Unit ring
SCALar | **ARRay,**	Scalar values only (incl. ramp matching) Scalar measured values and arrays	ARRay	–	–

Description of command	FW-Vers.
This command specifies the type of measured values.	1.0

CONFigure:MODulation:MERRor:EPSK:TCH:CONTrol:STATistics *<Statistics>* Statistics Count

<Statistics>	Description of parameters	Def. value	Def. unit	Unit ring
1 to 1000 | **NONE**	Number of bursts per statistics cycle Statistics off (equivalent to 1)	100	–	–

Description of command	FW-Vers.
This command defines the number of bursts forming a statistics cycle.	1.0

CONFigure:MODulation:MERRor:EPSK:TCH:CONTrol:REPetition *<Repetition>* ,*<StopCond>*,*<Stepmode>* Test Cycles

<Repetition>	Description of parameters	Def. value	Def. unit	Unit ring
CONTinuous | **SINGleshot |** **1 to 10000**	Continuous measurement (until `STOP` or `ABORT`) Single shot measurement (until `Status = RDY`) Multiple measurement (*counting*, until `Status = STEP | RDY`)	SING	–	
<StopCond>	**Description of parameters**	**Def. value**	**Def. unit**	**Unit ring**
SOERror | **NONE**	Stop measurement in case of error *(stop on error)* Continue measurement even in case of error	NONE	–	
<Stepmode>	**Description of parameters**	**Def. value**	**Def. unit**	**Unit ring**
STEP | **NONE**	Interrupt measurement after each statistics cycle Continue measurement according to its rep. mode	NONE	–	

Description of command	Sig. State	FW vers.
This command determines the number of statistics cycles, the stop condition and the stepping mode for the measurement. **Note:** *In the case of READ commands (`READ:...`), the <Repetition> parameter has no effect; the measurement is always stopped after a single shot.*	all	V2.80

DEFault:MODulation:MERRor:EPSK:TCH:CONTrol *<Mode>* Default Settings

<Enable>	Description of parameters	Def. value	Def. unit	Unit ring
ON | **OFF**	The parameters are set to their default values Some or all parameters differ from the default values	ON	–	

Description of command	Sig. State	FW vers.
If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to their default values (the setting *OFF* has no effect). If used as a query the command returns whether all parameters are set to their default values *(ON)* or not *(OFF)*.	all	V2.80

Tolerance values – Subsystem MODulation:OEMP:EPSK:TCH:LIMit

The subsystem *MODulation:OEMP:EPSK:TCH:LIMit* (see p. 6.123 ff) defines tolerance values for the modulation measurement **in all four EPSK applications**. The subsystem corresponds to the *Limits* tab in the popup menu *Modulation Configuration.*

Subsystem SUBarrays:MODulation

The subsystem *SUBarrays:MODulation* defines the measurement range and the type of output values.

CONFigure:SUBarrays:MODulation:MERRor:EPSK:TCH **<Mode>,<Start>,<Samples>{,<Start>,<Samples>}**			Definition of Subarrays	
<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
ALL | **ARIThmetical |** **MINimum |** **MAXimum,**	Return all measurement values Return arithm. mean value in every range Return minimum value in every range Return maximum value in every range	ALL	–	
<Start>	Description of parameters	Def. value	Def. unit	Unit ring
3 symb to 144 symb,	Start time in current range	0	symb	
<Samples>	Description of parameters	Def. value	Def. unit	Unit ring
0 to 142	Number of samples in current range	142	–	
Description of command			Sig. State	FW vers.
This command configures the `READ:SUBarrays...`, `FETCh:SUBarrays...`, and `SAMPle:SUBarrays:MODulation:MERRor:EPSK:TCH` commands. It restricts the measurement to up to 32 subranges where either all measurement results (the number of which is given by the second numerical parameter) or a single statistical value is returned. The subranges are defined by the start time and the number of test points which are located on a fixed, equidistant grid with a step width of 1 symb. The subranges may overlap but must be within the total range of the *Modulation* measurement. Test points outside this range are not measured (result *NAN)* and do not enter into the ARIThmetical, MINimum and MAXimum values. By default, only one range corresponding to the total measurement range is used and all measurement values are returned.			all	V2.80

Measured Values – Subsystem MODulation:MERRor:EPSK:TCH

The subsystem *MODulation:MERRor:EPSK:TCH* measures and returns the modulation parameters and compares them with the tolerance values. The subsystem corresponds to the various output elements in the measurement menu *Modulation,* application *Magn. Error 8PSK.*

READ[:SCALar]:MODulation:MERRor:EPSK:TCH? Scalar Results:
Start single shot measurement and return results
FETCh[:SCALar]:MODulation:MERRor:EPSK:TCH?
Read out meas. results (unsynchronized)
SAMPle[:SCALar]:MODulation:MERRor:EPSK:TCH?
Read out measurement results (synchronized)

Returned values	Value range	Def. value	Def. unit	Unit ring
95thPercentileMErr	0.0 % to 100.0 %	NAN	%	
EVMPeak (x3),	0.0 % to 100.0 %	NAN	%	
EVMRMS (x3),	0.0 % to 100.0 %	NAN	%	
OriginOffset (x3),	–100.0 dB to +100.0 dB	NAN	dB	
IQImbalance (x3),	–100.0 dB to +100.0 dB	NAN	dB	
FrequencyError (x3),	–1000.0 Hz to +1000.0 Hz	NAN	Hz	
AvgBurstPowerCurr,	–100.0 dBm to +20.0 dBm	NAN	dBm	
AvgBurstPowerAvg	–100.0 dBm to +20.0 dBm	NAN	dBm	
BurstsOutOfTol	0.0 % to 100.0 %	NAN	%	

Description of command	Sig. State	FW vers.
These commands are always queries. They start a modulation measurement and output all scalar measurement results (see chapter 4), either for the whole burst or for the 1st ten valid symbols in the burst. The calculation of results in an *average* or *peak* measurement is described in chapter 3 (see *calculation of statistical quantities*). The symbol (x3) behind a value indicates that the list contains three results corresponding to the *Current*, the *Average*, and the *MMax* value.	CCH TCH	V2.80

CALCulate[:SCALar]:MODulation:MERRor:EPSK:TCH:MATChing:LIMit?
Bursts out of Tolerance

Returned values	Value range	Def. value	Def. unit	Unit ring
95thPercentileMErr		INV	–	
MErrPeak (x3),		INV	–	
MErrRMS (x3),	**For all measured values:**	INV	–	
		INV	–	
OriginOffset (x3),				
IQImbalance (x3),	**NMAU |NMAL | INV | OK**	INV	–	
FrequencyError (x3)		INV	–	

Description of command	Sig. State	FW vers.
This command is always a query. It indicates whether and in which way the error limits for the scalar measured values (see above command) have been exceeded. The symbol (x3) behind a value indicates that the list contains three results corresponding to the *Current*, the *Average*, and the *MMax* value. The limits are defined with the `CONFigure:MODulation:OEMP`... commands. The following messages may be output for all measured values: NMAU Underflow of tolerance value *not matching, underflow* NMAL Tolerance value exceeded *not matching, overflow* INV Measurement invalid *invalid* OK all tolerances matched	CCH TCH	V2.80

READ:ARRay:MODulation:MERRor:EPSK:TCH:CURRent? **READ:ARRay:MODulation:MERRor:EPSK:TCH:AVERage?** **READ:ARRay:MODulation:MERRor:EPSK:TCH:MMAXimum?**				Magnitude Error in Burst
	Start single shot measurement and return results			*RUN*
FETCh:ARRay:MODulation:MERRor:EPSK:TCH:CURRent? **FETCh:ARRay:MODulation:MERRor:EPSK:TCH:AVERage?** **FETCh:ARRay:MODulation:MERRor:EPSK:TCH:MMAXimum?**				
	Read measurement results (unsynchronized)			*RUN*
SAMPle:ARRay:MODulation:MERRor:EPSK:TCH:CURRent? **SAMPle:ARRay:MODulation:MERRor:EPSK:TCH:AVERage?** **SAMPle:ARRay:MODulation:MERRor:EPSK:TCH:MMAXimum?**				
	Read measurement results (synchronized)			*RUN*
Returned values	Description of parameters	Def. value	Def. unit	Unit ring
0.0 % to +100.0 %,	1st value for magnitude error	NAN	%	
... ,	...	...	...	
0.0 % to +100.0 %	142nd value for magnitude error	NAN	%	
Description of command			Sig. State	FW vers.
These commands are always queries. They return the magnitude error vs. time at fixed, equidistant test points. The number of measured values is 142, corresponding to a time range of 3 symb to 144 symb. The calculation of *current, average, and mmax* (Min./Max.) results is explained in chapter 3 (see *display mode*).			CCH TCH	V2.80

READ:SUBarrays:MODulation:MERRor:EPSK:TCH:CURRent? Subarray Results
READ:SUBarrays:MODulation:MERRor:EPSK:TCH:AVERage?
READ:SUBarrays:MODulation:MERRor:EPSK:TCH:MMAXimum?
Start single shot measurement and return results *RUN*
FETCh:SUBarrays:MODulation:MERRor:EPSK:TCH:CURRent?
FETCh:SUBarrays:MODulation:MERRor:EPSK:TCH:AVERage?
FETCh:SUBarrays:MODulation:MERRor:EPSK:TCH:MMAXimum?
Read meas. results (unsynchronized) *RUN*
SAMPle:SUBarrays:MODulation:MERRor:EPSK:TCH:CURRent?
SAMPle:SUBarrays:MODulation:MERRor:EPSK:TCH:AVERage?
SAMPle:SUBarrays:MODulation:MERRor:EPSK:TCH:MMAXimum?
Read results (synchronized) *RUN*

Ret. values per subrange	Description of parameters	Def. value	Def. unit	Unit ring
0.0 % to +100.0 %,	1st value for magnitude error	NAN	%	
... ,	...	...	...	
0.0 % to +100.0 %	nth value for magnitude error	NAN	%	

Description of command	Sig. State	FW vers.
These commands are always queries. They measure and return the magnitude error versus time in the subranges defined by means of the `CONFigure:SUBarrays:MODulation:MERRor:EPSK:TCH` command. In the default setting of the configuration command the `READ:SUBarrays...`, `FETCh:SUBarrays...`, and `SAMPle:SUBarrays...` command group is equivalent to the `READ:ARRay...`, `FETCh:ARRay...`, and `SAMPle:ARRay...` command group described above. The `CONFigure:SUBarrays:MODulation:MERRor:EPSK:TCH` command defines a maximum of 32 subranges. If one of the statistical modes `(ARIThmetical, MINimum, MAXimum)` is set, only one value is returned per subrange. The calculation of *current, average, minimum,* and *maximum* results is explained in chapter 3 (see *display mode*).	CCH TCH	V2.80

Test Object SPECtrum[:COMMon]

The subsystem *SPECtrum[:COMMon]* provides settings that are common to the two applic*ations Spectrum due to Modulation* (see p. 6.147 ff) and *Spectrum due to Switching* (see p. 6.157 ff).

CONFigure:SPECtrum[:COMMon]:NOISe:CORRection *<Enable>*				Noise Correction
<Enable>	Description of parameters	Def. value	Def. unit	Unit ring
ON | OFF	Switch noise correction on or off	ON	–	–
Description of command			Sig. State	FW vers.
This command switches the noise correction for the Spectrum measurement on or off. The noise correction improves the dynamic range but slightly reduces the speed of the measurement.			all	V2.80

Test Object SPECtrum due to Modulation

The subsystem *SPECtrum:MODulation* measures the off-carrier power due to the modulation of the GSM signal. The subsystem corresponds to the measurement menus *Spectrum* and the associated configuration popups.

Important Note!

The keywords `:GMSK` *and* `:EPSK` *in the remote control commands denote GMSK and 8PSK modulation, respectively. The* `:EPSK` *commands are available with option CMU-K41 only.*

Measurement configurations are generally possible in all signalling states. However, to `INITiate`, `ABORt`, `STOP`, `CONTinue` *a measurement, and to obtain measurement results, the command* `PROCedure:SIGNalling:ACTion` *must be used to access either the* TCH *mode (commands including the keyword* `:TCH`*; traffic channel tests) or the* CCH *mode (commands including the keyword* `:CCH`*; control channel tests).*

`:EPSK` *measurements are available in the* TCH *test mode only.*

Control of Measurement

The subsystem *SPECtrum:MODulation* controls the spectrum measurement.

INITiate:SPECtrum:MODulation:GMSK:CCH **INITiate:SPECtrum:MODulation:GMSK:TCH** **NITiate:SPECtrum:MODulation:EPSK:TCH**	Start new measurement	*RUN*
ABORt:SPECtrum:MODulation:GMSK:CCH **ABORt:SPECtrum:MODulation:GMSK:TCH** **ABORt:SPECtrum:MODulation:EPSK:TCH**	Abort running meas. and switch off	*OFF*
STOP:SPECtrum:MODulation:GMSK:CCH **STOP:SPECtrum:MODulation:GMSK:TCH** **STOP:SPECtrum:MODulation:EPSK:TCH**	Stop meas. after current stat. cycle	*STOP*
CONTinue:SPECtrum:MODulation:GMSK:CCH **CONTinue:SPECtrum:MODulation:GMSK:TCH** **CONTinue:SPECtrum:MODulation:EPSK:TCH**	Next meas. step (only *stepping mode*)	*RUN*

Description of command	Sig. State	FW vers.
These commands do not exist as queries. They start or stop the measurement, setting it to the status indicated in the top right column.	CCH TCH	V2.80

CONFigure:SPECtrum:MODulation:GMSK:CCH:EREPorting *<Mode>* Event Reporting
CONFigure:SPECtrum:MODulation:GMSK:TCH:EREPorting *<Mode>*
CONFigure:SPECtrum:MODulation:EPSK:TCH:EREPorting *<Mode>>*

<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
SRQ |	Service request	OFF	–	–
SOPC |	Single operation complete			
SRSQ |	SRQ and SOPC			
OFF	No reporting			

Description of command	Sig. State	FW vers.
This command defines the events generated when the measurement is terminated or stopped *(event reporting,* see chapter 5 of CMU200 manual).	all	V2.80

FETCh:SPECtrum:MODulation:GMSK:CCH:STATus?
FETCh:SPECtrum:MODulation:GMSK:TCH:STATus?
FETCh:SPECtrum:MODulation:EPSK:TCH:STATus? Measurement status

Return	Description of parameters	Def. value	Def. unit	Unit ring
OFF |	Measurement in the *OFF* state (`*RST` or `ABORt`)	OFF	–	–
RUN |	Running (after `INITiate, CONTinue` or `READ`)			
STOP |	Stopped (`STOP`)			
ERR |	*OFF* (could not be started)			
STEP |	Stepping mode *(<stepmode>=STEP)*			
RDY,	Stopped according to repetition mode and stop condition			
1 to 10000 |	Counter for current statistics cycle			
NONE,	No counting mode set	NONE	–	–
1 to 1000 |	Counter for current evaluation period within a cycle			
NONE	Statistic count set to off	NONE	–	–

Description of command	Sig. State	FW vers.
This command is always a query. It returns the status of the measurement (see chapters 3 and 5).	all	V2.80

Subsystem SPECtrum:MODulation...:CONTrol

The subsystem *SPECtrum:MODulation...:CONTrol* defines the repetition mode, statistic count, and stop condition of the measurement. These settings are provided in the *Control* and *Statistics* tabs in the popup menu *Spectrum Configuration.*

CONFigure:SPECtrum:MODulation:GMSK:CCH:CONTrol *<Mode>, <Statistics>, <Repetition>, <StopCond>, <Stepmode>*
CONFigure:SPECtrum:MODulation:GMSK:TCH:CONTrol *<Mode>, <Statistics>, <Repetition>, <StopCond>, <Stepmode>*
CONFigure:SPECtrum:MODulation:EPSK:TCH:CONTrol *<Mode>, <Statistics>, <Repetition>, <StopCond>, <Stepmode>* Scope of Measurement

<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
SCALar | **ARRay,**	Scalar values only (incl. ramp matching) Scalar measured values and arrays	ARRay	–	–
<Statistics>	**Description of parameters**	**Def. value**	**Def. unit**	**Unit ring**
1 to 1000 | **NONE**	Number of bursts per statistics cycle Statistics off (equivalent to 1)	100	–	–
<Repetition>	**Description of parameters**	**Def. value**	**Def. unit**	**Unit ring**
CONTinuous | **SINGleshot |** **1 to 10000,**	Continuous measurement (until `STOP` or `ABORT`) Single shot measurement (until `Status = RDY`) Multiple measurement (*counting*, until `Status = STEP | RDY`)	SING	–	–
<StopCond>	**Description of parameters**	**Def. value**	**Def. unit**	**Unit ring**
SOERror | **NONE,**	Stop measurement in case of error *(stop on error)* Continue measurement even in case of error	NONE	–	–
<Stepmode>	**Description of parameters**	**Def. value**	**Def. unit**	**Unit ring**
STEP | **NONE**	Interrupt measurement after each statistics cycle Continue measurement according to its rep. mode	NONE	–	–
Description of command			**Sig. State**	**FW vers.**
This command defines the scope of the spectrum measurement, combining the `...CONTrol:RMODe`, `...CONTrol:STATistics`, and the `...CONTrol:REPetition` commands (see below).			all	V2.80

CONFigure:SPECtrum:MODulation:GMSK:CCH:CONTrol:RMODe *<Mode>* Result Mode
CONFigure:SPECtrum:MODulation:GMSK:TCH:CONTrol:RMODe *<Mode>*
CONFigure:SPECtrum:MODulation:EPSK:TCH:CONTrol:RMODe *<Mode>*

<Mode>	Desciption of parameters	Def. value	Def. unit	Unit ring
SCALar | **ARRay,**	Scalar values only (incl. ramp matching) Scalar measured values and arrays	ARRay	–	–
Description of command			**Sig. State**	**FW vers.**
This command specifies the type of measured values.			all	V2.80

CONFigure:SPECtrum:MODulation:GMSK:CCH:CONTrol:STATistics *<Statistics>*Statistics Count
CONFigure:SPECtrum:MODulation:GMSK:TCH:CONTrol:STATistics *<Statistics>*
CONFigure:SPECtrum:MODulation:EPSK:TCHCONTrol:STATistics *<Statistics>*

<Statistics>	Description of parameters	Def. value	Def. unit	Unit ring
1 to 1000 | **NONE**	Number of bursts per statistics cycle Statistics off (equivalent to 1)	100	–	–
Description of command			**Sig. State**	**FW vers.**
This command defines the number of bursts forming a statistics cycle.			all	V2.80

CONFigure:SPECtrum:MODulation:GMSK:CCH:CONTrol:REPetition
CONFigure:SPECtrum:MODulation:GMSK:TCH:CONTrol:REPetition
CONFigure:SPECtrum:MODulation:EPSK:TCH:CONTrol:REPetition
<Repetition>,<StopCondition>, ><Stepmode>

Test Cycles

<Repetition>	Description of parameters	Def. value	Def. unit	Unit ring
CONTinuous |	Continuous measurement (*continuous*, until `STOP` or `ABORT`)	SING	–	–
SINGleshot |	Single measurement *(single shot,* `until Status = RDY`)			
1 to 10000,	Multiple measurement (*counting*, until `Status = STEP | RDY`)			

<StopCondition>	Description of parameters	Def. value	Def. unit	Unit ring
SOERror | **NONE,**	Stop measurement in case of error *(stop on error)* Continue measurement even in case of error	NONE	–	–

<Stepmode>	Description of parameters	Def. value	Def. unit	Unit ring
STEP | **NONE**	Interrupt measurement after each statistics cycle Continue measurement according to its rep. mode	NONE	–	–

Description of command	Sig. State	FW vers.
This command defines the number of test cycles, the stepping mode and, if required, a stop condition for the measurement. **Note:** *In the case of READ commands (`READ:...`), the <Repetition> parameter has no effect; the measurement is always stopped after a single shot.*	all	V2.80

DEFault:SPECtrum:MODulation:GMSK:CCH:CONTrol *<Enable>*
DEFault:SPECtrum:MODulation:GMSK:TCH:CONTrol *<Enable>*
DEFault:SPECtrum:MODulation:EPSK:TCH:CONTrol *<Enable>*

Default Settings

<Enable>	Description of parameters	Def. value	Def. unit	Unit ring
ON | **OFF**	All parameters are set to their default values Some or all parameters differ from the default values	ON	–	

Description of command	Sig. State	FW vers.
If used with *ON*, this command sets all the parameters of the subsystem to their default values. (*OFF* has no effect). In the query format, the command returns *ON* if all the parameters of the subsystem correspond to their default values, otherwise it returns *OFF*.	all	V2.80

Test Configuration

The commands of the following subsystems configure the spectrum due to modulation. They correspond to the *due to Modulation* sections in the *Spectrum Configuration* menu.

Subsystem SPECTrum:MODulation...:LIMit:LINE

The subsystem *SPECtrum:MODulation...:LIMit:LINE* defines the limit lines, i.e. the tolerance values for the spectrum measurement. The subsystem corresponds to the tab *Limit Lines* in the popup menu *Spectrum Configuration.*

CONFigure:SPECtrum:MODulation:GMSK:CCH:LIMit:LINE:SYMMetric[:COMBined] Limits
:FREQuency<nr>
CONFigure:SPECtrum:MODulation:GMSK:TCH:LIMit:LINE:SYMMetric[:COMBined]
:FREQuency<nr>
CONFigure:SPECtrum:MODulation:EPSK:TCH:LIMit:LINE:SYMMetric[:COMBined]
:FREQuency<nr>
<MinPwLevelRel>, <MaxPwLevelRel>, <AbsPwLevel>, <Enable>
CONFigure:SPECtrum:MODulation:GMSK:CCH:LIMit:LINE:SYMMetric[:COMBined]
:FREQuency<nr>:ENABle <Enable>
CONFigure:SPECtrum:MODulation:GMSK:TCH:LIMit:LINE:SYMMetric[:COMBined]
:FREQuency<nr>:ENABle <Enable>
CONFigure:SPECtrum:MODulation:EPSK:TCH:LIMit:LINE:SYMMetric[:COMBined]
:FREQuency<nr>:ENABle <Enable>
CONFigure:SPECtrum:MODulation:GMSK:CCH:LIMit:LINE:SYMMetric[:COMBined]
:FREQuency<nr>:VALue
CONFigure:SPECtrum:MODulation:GMSK:TCH:LIMit:LINE:SYMMetric[:COMBined]
:FREQuency<nr>:VALue
CONFigure:SPECtrum:MODulation:EPSK:TCH:LIMit:LINE:SYMMetric[:COMBined]
:FREQuency<nr>:VALue
<MinPwLevelRel>, <MaxPwLevelRel>, <AbsPwLevel> Limits

Numeric Suffix	Value range	Description of parameters	Def. value
<nr>	1 to11	Measurement point (frequency) no.	
Parameters	Value range	Description of parameters	Def. value
<Enable>	ON | OFF	Limit check for frequency point <nr> on/off	See below
<MinPwLevelRel>,	–99.9 dB to 99.9 dB	Limit for relative power below the interpolation range	
<MaxPwLevelRel>,	–99.9 dB to 99.9 dB	Limit for relative power above the interpolation range	
<AbsPwLevel>	–99.9 dBm to 99.9 dBm	Alternative absolute power limit	

Description of command	Sig. State	FW vers.
These commands activate and define limit lines for the spectrum due to modulation measurement. The limits are defined at up to 11 fixed frequencies numbered by the numeric suffix <nr> and as a function of the BTS output power level. Outside the interpolation range defined via `CONFigure:SPECtrum:MODulation:GMSK:GMSK:LIMit:LINE:SYMMetric[:COMBined]:RPOWer`, the fixed relative power limits *<MinPwLevelRel> and <MaxPwLevelRel>* apply. Inside this range, the limits are derived from these values by linear interpolation. As an alternative, an absolute power limit is set. For a more detailed explanation see chapter 4. For totally switching on or off the limit check please use the commands `CONFigure:SPECtrum:MODulation:...LIMit:LINE:SYMMetric[:COMBined]:ENABle <Mode>`	all	V2.80

Default values for GSM400/900 (the GSM1800/1900 values are given in brackets where they differ from the GSM900 values):

Frequency	Min.P. Lev.rel.	Max.P. Lev.rel.	Level abs.
± 0.10 MHz	+0.5 dB	+ 0.5 dB	–65.0 dBm (–57.0 dBm)
± 0.20 MHz	–30.0 dB	– 30.0 dB	–65.0 dBm (–57.0 dBm)
± 0.25 MHz	–33.0 dB	– 33.0 dB	–65.0 dBm (–57.0 dBm)
± 0.40 MHz	–60.0 dB[5]	– 60.0 dB[5]	–65.0 dBm (–57.0 dBm)
± 0.60 MHz	–60.0 dB	– 70.0 dB	–65.0 dBm (–57.0 dBm)
± 0.80 MHz	–60.0 dB	– 70.0 dB	–65.0 dBm (–57.0 dBm)
± 1.00 MHz	–60.0 dB	– 70.0 dB	–65.0 dBm (–57.0 dBm)
± 1.20 MHz	–63.0 dB	– 73.0 dB	–65.0 dBm (–57.0 dBm)
± 1.40 MHz	–63.0 dB	– 73.0 dB	–65.0 dBm (–57.0 dBm)
± 1.60 MHz	–63.0 dB	– 73.0 dB	–65.0 dBm (–57.0 dBm)
± 1.80 MHz	–63.0 dB	– 73.0 dB	–65.0 dBm (–57.0 dBm)

CONFigure:SPECtrum:MODulation:GMSK:CCH:LIMit:LINE:SYMMetric[:COMBined]:RPOWer
CONFigure:SPECtrum:MODulation:GMSK:TCH:LIMit:LINE:SYMMetric[:COMBined]:RPOWer
CONFigure:SPECtrum:MODulation:EPSK:TCH:LIMit:LINE:SYMMetric[:COMBined]:RPOWer
<Minimum>, <Maximum> Reference Power

<Minimum>	Description of parameters	Def. value	Def. unit	Unit ring
–99.9 dBm to +99.9 dBm	Ref. power for min. power level	33	dBm	–
<Maximum>	Description of parameters	Def. value	Def. unit	Unit ring
–99.9 dBm to +99.9 dBm	Ref. power for max. power level	43	dBm	–

Description of command	Sig. State	FW vers.
This command defines the BTS output power range where the relative limit lines are given by linear interpolation between a minimum and a maximum relative power level. See command `CONFigure:SPECtrum:MODulation...:LIMit:LINE:UPPer<nr>` and detailed explanation in chapter 4.	all	V2.80

CONFigure:SPECtrum:MODulation:GMSK:CCH:LIMit:LINE:SYMMetric[:COMBined]:ENABle
<Mode>
CONFigure:SPECtrum:MODulation:GMSK:TCH:LIMit:LINE:SYMMetric[:COMBined]:ENABle
<Mode>
CONFigure:SPECtrum:MODulation:EPSK:TCH:LIMit:LINE:SYMMetric[:COMBined]:ENABle
<Mode> Limits on/off

<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
ON | **OFF**	Switch on limit check Switch off limit check	ON	–	–

Description of command	Sig. State	FW vers.
This command switches the limit check for all measurepoints.	all	V2.80

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[5] GMSK modulation. With 8PSK modulation, the corresponding value is –56.0 dB.

DEFault:SPECtrum:MODulation:GMSK:CCH:LIMit:LINE *<Enable>*
DEFault:SPECtrum:MODulation:GMSK:TCH:LIMit:LINE *<Enable>*
DEFault:SPECtrum:MODulation:EPSK:TCH:LIMit:LINE *<Enable>* Default Settings

<Enable>	Description of parameters	Def. value	Def. unit	Unit ring
ON | **OFF**	All parameters are set to their default values Some or all parameters differ from the default values	ON	–	

Description of command	Sig. State	FW vers.
If used with *ON*, this command sets all the parameters of the subsystem to their default values. (*OFF* has no effect). In the query format, the command returns *ON* if all the parameters of the subsystem correspond to their default values, otherwise it returns *OFF*.	all	V2.80

Subsystem SPECTrum:MODulation...:MPOint<nr>

The subsystem *SPECtrum:MODulation...:MPOint<nr>* defines at which frequencies the *Spectrum* measurement is performed. The subsystem corresponds to the tab *Meas X* in the popup menu *Spectrum Configuration.*

CONFigure:SPECtrum:MODulation:GMSK:CCH:MPOint<nr>:ENABle <Enable>
CONFigure:SPECtrum:MODulation:GMSK:TCH:MPOint<nr>:ENABle <Enable>
CONFigure:SPECtrum:MODulation:EPSK:TCH:MPOint<nr>:ENABle <Enable>
Enable/Disable Measurement Points

<Enable>	Description of parameters	Def. value	Def. unit	Unit ring
ON | **OFF**	Switch on measurement point <nr> Switch off measurement point <nr>	ON	–	–

Description of command	Sig. State	FW vers.
This command switches the measurement at the individual frequency points no. 1 to 11 (numbered by the numeric suffix <nr>) on or off.	all	V2.80

Subsystem SUBarrays:SPECtrum:MODulation

The subsystem *SUBarrays:SPECtrum:MODulation* defines the measurement range and the type of output values.

CONFigure:SUBarrays:SPECtrum:MODulation:GMSK:CCH Definition of Subarrays
CONFigure:SUBarrays:SPECtrum:MODulation:GMSK:TCH
CONFigure:SUBarrays:SPECtrum:MODulation:EPSK:TCH
<Mode>,<Start>,<Samples>{,<Start>,<Samples>}

<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
ALL |	Return all measurement values	ALL	–	
ARIThmetical |	Return arithm. mean value in every range			
MINimum |	Return minimum value in every range			
MAXimum,	Return maximum value in every range			
<Start>	**Description of parameters**	**Def. value**	**Def. unit**	**Unit ring**
–1.8 MHz to 1.8 MHz,	Frequency of first point in current range	–1.8	MHz	
<Samples>	**Description of parameters**	**Def. value**	**Def. unit**	**Unit ring**
1 to 23	Number of samples in current range	23	–	

Description of command	Sig. State	FW vers.
This command configures the `READ:SUBarrays..`, `FETCh:SUBarrays..`, and `SAMPle:SUBarrays:SPECtrum:MODulation...` commands. It restricts the measurement to up to 32 subranges where either all measurement results (the number of which is given by the second numerical parameter) or a single statistical value is returned. The subranges are defined by the start frequency and the number of test points which are located at fixed frequencies (see command `CONFigure:SPECtrum:MODulation...LIMit:LINE...`). The subranges may overlap but must be within the total range of the *spectrum due to modulation* measurement. Test points outside this range are not measured (result *NAN)* and do not enter into the ARIThmetical, MINimum and MAXimum values. By default, only one range corresponding to the total measurement range is used and all measurement values are returned.	all	V2.80

Measured Values

The commands of the following subsystems determine and return the results of the spectrum due to modulation measurement. They correspond to the graphical menu *Spectrum* with its various display elements.

Subsystem SPECtrum:MODulation...

The subsystem *SPECtrum:MODulation...* measures and returns of the frequency spectum (due to modulation) and compares it with tolerance values. The subsystem corresponds to the graphical measurement menu *Spectrum.*

READ[:SCALar]:SPECtrum:MODulation:GMSK:CCH? Scalar Results
READ[:SCALar]:SPECtrum:MODulation:GMSK:TCH?
READ[:SCALar]:SPECtrum:MODulation:EPSK:TCH?
Start single shot measurement and return results
FETCh[:SCALar]:SPECtrum:MODulation:GMSK:CCH?
FETCh[:SCALar]:SPECtrum:MODulation:GMSK:TCH?
FETCh[:SCALar]:SPECtrum:MODulation:EPSK:TCH? Read out meas. results (unsynchronized)
SAMPle[:SCALar]:SPECtrum:MODulation:GMSK:CCH?
SAMPle[:SCALar]:SPECtrum:MODulation:GMSK:TCH?
SAMPle[:SCALar]:SPECtrum:MODulation:EPSK:TCH? Read out meas. results (synchronized)

Return	Value range	Def. value	Def. unit	Unit ring
Reference Power,	–100,0 dBm to +20,0 dBm	NAN	dBm	
Matching	INV | MATC | NMAT | NTSC | OUT | NTRG | OFLW | UFLW	INV	–	

Description of command	Sig. State	FW vers.
These commands are always queries.	CCH TCH	V2.80

- `READ` starts a single shot measurement and returns the results.
- `FETCh` outputs the results without taking care of the measurement state.
- `SAMPle` waits until the results are valid for the first time (depending on the chosen statistic count) and then outputs the results.

For more details refer to the description of measurement control in chapter 5 of the CMU200 operating manual.

The reference power is the absolute carrier power measured as specified in the GSM standard. The following messages may be output for the value *Matching*:

MATC	*matching*
NMAT	*not matching*
INV	*invalid*
NTSC	*no training sequence code*
OUT	*out of range*
NTRG	*not triggered*
UFLW	*underflow*
OFLW	*overflow*

READ:ARRay:SPECtrum:MODulation:GMSK:CCH? Spectrum Results
READ:ARRay:SPECtrum:MODulation:GMSK:TCH?
READ:ARRay:SPECtrum:MODulation:EPSK:TCH?
Start single shot measurement and return results
FETCh:ARRay:SPECtrum:MODulation:GMSK:CCH?
FETCh:ARRay:SPECtrum:MODulation:GMSK:TCH?
FETCh:ARRay:SPECtrum:MODulation:EPSK:TCH?
Read measurement results (unsynchronized)
SAMPle:ARRay:SPECtrum:MODulation:GMSK:CCH?
SAMPle:ARRay:SPECtrum:MODulation:GMSK:TCH?
SAMPle:ARRay:SPECtrum:MODulation:EPSK:TCH? Read results (synchronized)

Return	Description of parameters	Def. value	Def. unit	Unit ring
–100.0 dB to + 20.0 dB,	Power at measurement point 1	NAN	dBm	FG Power Level
...,	...	...	...	
–100.0 dB to + 20.0 dB	Power at measurement point 23	NAN	dBm	

Description of command	Sig. State	FW vers.
These commands are always queries. They return the off-carrier power due to modulation at all measurement points.	CCH TCH	V2.80

READ:SUBarrays:SPECtrum:MODulation:GMSK:CCH? Subarray Results
READ:SUBarrays:SPECtrum:MODulation:GMSK:TCH?
READ:SUBarrays:SPECtrum:MODulation:EPSK:TCH?
Start single shot measurement and return results
FETCh:SUBarrays:SPECtrum:MODulation:GMSK:CCH?
FETCh:SUBarrays:SPECtrum:MODulation:GMSK:TCH?
FETCh:SUBarrays:SPECtrum:MODulation:EPSK:TCH?
Read measurement results (unsynchronized)
SAMPle:SUBarrays:SPECtrum:MODulation:GMSK:CCH?
SAMPle:SUBarrays:SPECtrum:MODulation:GMSK:TCH?
SAMPle:SUBarrays:SPECtrum:MODulation:EPSK:TCH? Read results (synchronized)

Ret. values per subrange	Description of parameters	Def. value	Def. unit	Unit ring
–100.0 dB to + 20.0 dB	Power at measurement point 1	NAN	dB	
...	...	...	...	
–100.0 dB to + 20.0 dB	Power at measurement point n	NAN	dB	

Description of command	Sig. State	FW vers.
These commands are always queries. They output the off-carrier power due to modulation in the subranges defined by means of the CONFigure:SUBarrays:SPECtrum:MODulation:GMSK command. In the default setting of the configuration command the READ:SUBarrays..., FETCh:SUBarrays..., and SAMPle:SUBarrays... command group is equivalent to the READ:ARRay..., FETCh:ARRay..., and SAMPle:ARRay... command group described above. The CONFigure:SUBarrays:SPECtrum:MODulation:GMSK command defines a maximum of 32 subranges. If one of the statistical modes (ARIThmetical, MINimum, MAXimum) is set, only one value is returned per subrange.	CCH TCH	V2.80

Test Object SPECtrum due to SWITching

The subsystem *SPECtrum:SWITching* measures the off-carrier power due to the bursty nature of the GSM signal. The subsystem corresponds to the measurement menu *Spectrum* and the associated configuration popups

Important Note!

The keywords `:GMSK` *and* `:EPSK` *in the remote control commands denote GMSK and 8PSK modulation, respectively. The* `:EPSK` *commands are available with option CMU-K41 only.*

Measurement configurations are generally possible in all signalling states. However, to `INITiate`, `ABORt`, `STOP`, `CONTinue` *a measurement, and to obtain measurement results, the command* `PROCedure:SIGNalling:ACTion` *must be used to access either the* TCH *mode (commands including the keyword* `:TCH`*; traffic channel tests) or the* CCH *mode (commands including the keyword* `:CCH`*; control channel tests).*

`:EPSK` *measurements are available in the* TCH *test mode only.*

Control of Measurement – Subsystem SPECtrum:SWITching

The subsystem *SPECtrum:SWITching* controls the spectrum measurement.

INITiate:SPECtrum:SWITching:GMSK:CCH **INITiate:SPECtrum:SWITching:GMSK:TCH** **INITiate:SPECtrum:SWITching:EPSK:TCH**	Start new measurement	*RUN*
ABORt:SPECtrum:SWITching:GMSK:CCH **ABORt:SPECtrum:SWITching:GMSK:TCH** **ABORt:SPECtrum:SWITching:EPSK:TCH**	Abort running meas. and switch off	*OFF*
STOP:SPECtrum:SWITching:GMSK:CCH **STOP:SPECtrum:SWITching:GMSK:TCH** **STOP:SPECtrum:SWITching:EPSK:TCH**	Stop meas. after current stat. cycle	*STOP*
CONTinue:SPECtrum:SWITching:GMSK:CCH **CONTinue:SPECtrum:SWITching:GMSK:TCH** **CONTinue:SPECtrum:SWITching:EPSK:TCH**	Next meas. step (only *stepping mode*)	*RUN*

Description of command	Sig. State	FW vers.
These commands do not exist as queries. They start or stop the measurement, setting it to the status indicated in the top right column.	CCH TCH	V2.80

CONFigure:SPECtrum:SWITching:GMSK:CCH:EREPorting *<Mode>*
CONFigure:SPECtrum:SWITching:GMSK:TCH:EREPorting *<Mode>*
CONFigure:SPECtrum:SWITching:EPSK:TCH:EREPorting *<Mode>* Event Reporting

<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
SRQ | **SOPC |** **SRSQ |** **OFF**	Service request Single operation complete SRQ and SOPC No reporting	OFF	–	–
Description of command			Sig. State	FW vers.
This command defines the events generated when the measurement is terminated or stopped *(event reporting,* see chapter 5 of CMU200 manual).			all	V2.80

FETCh:SPECtrum:SWITching:GMSK:CCH:STATus?
FETCh:SPECtrum:SWITching:GMSK:TCH:STATus?
FETCh:SPECtrum:SWITching:EPSK:TCH:STATus? Measurement Status

Return	Description of parameters	Def. value	Def. unit	Unit ring
OFF | **RUN |** **STOP |** **ERR |** **STEP |** **RDY,**	Measurement in the *OFF* state (`*RST` or `ABORt`) Running (after `INITiate, CONTinue` or `READ`) Stopped (`STOP`) *OFF* (could not be started) Stepping mode *(<stepmode>=STEP)* Stopped according to repetition mode and stop condition	OFF	–	–
1 to 10000 | **NONE,**	Counter for current statistics cycle No counting mode set	NONE	–	–
1 to 1000 | **NONE**	Counter for current evaluation period within a cycle Statistic count set to off	NONE	–	–
Description of command			Sig. State	FW vers.
This command is always a query. It returns the status of the measurement (see chapters 3 and 5).			all	V2.80

Subsystem SPECtrum:SWITching...:CONTrol

The subsystem *SPECtrum:SWITching...:CONTrol* defines the repetition mode, statistic count, and stop condition of the measurement. These settings are provided in the *Control* and *Statistics* tabs in the popup menu *Spectrum Configuration*.

CONFigure:SPECtrum:SWITching:GMSK:CCH:CONTrol *<Mode>, <Statistics>, <Repetition>, <StopCond>, <Stepmode>*
CONFigure:SPECtrum:SWITching:GMSK:TCH:CONTrol *<Mode>, <Statistics>, <Repetition>, <StopCond>, <Stepmode>*
CONFigure:SPECtrum:SWITching:EPSK:TCH:CONTrol *<Mode>, <Statistics>, <Repetition>, <StopCond>, <Stepmode>* Scope of Measurement

<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
SCALar | **ARRay,**	Scalar values only (incl. ramp matching) Scalar measured values and arrays	ARRay	–	–
<Statistics>	Description of parameters	Def. value	Def. unit	Unit ring
1 to 1000 | **NONE**	Number of bursts per statistics cycle Statistics off (equivalent to 1)	100	–	–
<Repetition>	Description of parameters	Def. value	Def. unit	Unit ring
CONTinuous | **SINGleshot |** **1 to 10000,**	Continuous measurement (until `STOP` or `ABORT`) Single shot measurement (until `Status = RDY`) Multiple measurement (*counting*, until `Status = STEP | RDY`)	SING	–	–
<StopCond>	Description of parameters	Def. value	Def. unit	Unit ring
SOERror | **NONE,**	Stop measurement in case of error *(stop on error)* Continue measurement even in case of error	NONE	–	–
<Stepmode>	Description of parameters	Def. value	Def. unit	Unit ring
STEP | **NONE**	Interrupt measurement after each statistics cycle Continue measurement according to its rep. mode	NONE	–	–
Description of command			Sig. State	FW vers.
This command defines the scope of the spectrum measurement, combining the `...CONTrol:RMODe`, `...CONTrol:STATistics`, and the `...CONTrol:REPetition` commands (see below).			all	V2.80

CONFigure:SPECtrum:SWITching:GMSK:CCH:CONTrol:RMODe *<Mode>* Result Mode
CONFigure:SPECtrum:SWITching:GMSK:TCH:CONTrol:RMODe *<Mode>*
CONFigure:SPECtrum:SWITching:EPSK:TCH:CONTrol:RMODe *<Mode>*

<Mode>	Desciption of parameters	Def. value	Def. unit	Unit ring
SCALar | **ARRay,**	Scalar values only (incl. ramp matching) Scalar measured values and arrays	ARRay	–	–
Description of command			Sig. State	FW vers.
This command specifies the type of measured values.			all	V2.80

CONFigure:SPECtrum:SWITching:GMSK:CCH:CONTrol:STATistics *<Statistics>* Statistics Count
CONFigure:SPECtrum:SWITching:GMSK:TCH:CONTrol:STATistics *<Statistics>*
CONFigure:SPECtrum:SWITching:EPSK:TCHCONTrol:STATistics *<Statistics>*

<Statistics>	Description of parameters	Def. value	Def. unit	Unit ring
1 to 1000 | **NONE**	Number of bursts per statistics cycle Statistics off (equivalent to 1)	100	–	–
Description of command			Sig. State	FW vers.
This command defines the number of bursts forming a statistics cycle.			all	V2.80

CONFigure:SPECtrum:SWITching:GMSK:CCH:CONTrol:REPetition
CONFigure:SPECtrum:SWITching:GMSK:TCH:CONTrol:REPetition
CONFigure:SPECtrum:SWITching:EPSK:TCH:CONTrol:REPetition
<Repetition>,<StopCondition>, <Stepmode> Test Cycles

<Repetition>	Description of parameters	Def. value	Def. unit	Unit ring
CONTinuous |	Continuous measurement (until `STOP` or `ABORT`)	SING	–	–
SINGleshot |	Single shot measurement (until `Status = RDY`)			
1 to 10000	Multiple measurement (*counting*, until `Status = STEP | RDY`)			
<StopCondition>	Description of parameters	Def. value	Def. unit	Unit ring
SOERror |	Stop measurement in case of error *(stop on error)*	NONE	–	–
NONE	Continue measurement even in case of error			
<Stepmode>	Description of parameters	Def. value	Def. unit	Unit ring
STEP |	Interrupt measurement after each statistics cycle	NONE	–	–
NONE	Continue measurement according to its rep. mode			
Description of command			Sig. State	FW vers.
This command defines the number of test cycles, the stepping mode and, if required, an stop condition for the measurement. **Note:** *In the case of READ commands (`READ:...`), the <Repetition> parameter has no effect; the measurement is always stopped after a single shot*			all	V2.80

DEFault:SPECtrum:SWITching:GMSK:CCH:CONTrol *<Enable>*
DEFault:SPECtrum:SWITching:GMSK:TCH:CONTrol *<Enable>*
DEFault:SPECtrum:SWITching:EPSK:TCH:CONTrol *<Enable>* Default Settings

<Enable>	Description of parameters	Def. value	Def. unit	Unit ring
ON |	All parameters are set to their default values	ON	–	
OFF	Some or all parameters differ from the default values			
Description of command			Sig. State	FW vers.
If used with *ON*, this command sets all the parameters of the subsystem to their default values. (*OFF* has no effect). In the query format, the command returns *ON* if all the parameters of the subsystem correspond to their default values, otherwise it returns *OFF*.			all	V2.80

Test Configuration

The commands of the following subsystems configure the spectrum due to switching. They correspond to the *due to Switching* sections in the *Spectrum Configuration* menu.

Subsystem SPECTrum:SWITching...:LIMit:LINE

The subsystem *SPECtrum:SWITching:GMSK...:LIMit:LINE* defines the limit lines, i.e. the tolerance values for the spectrum measurement. The subsystem corresponds to the tab *Limit Lines* in the popup menu *Spectrum Configuration.*

CONFigure:SPECtrum:SWITching:GMSK:CCH:LIMit:LINE:SYMMetric[:COMBined]
:FREQuency<nr>
CONFigure:SPECtrum:SWITching:GMSK:TCH:LIMit:LINE:SYMMetric[:COMBined]
:FREQuency<nr>
CONFigure:SPECtrum:SWITching:EPSK:TCH:LIMit:LINE:SYMMetric[:COMBined]
:FREQuency<nr>
<MinPwLevelRel>, <MaxPwLevelRel>, <AbsPwLevel>, <Enable>
CONFigure:SPECtrum:SWITching:GMSK:CCH:LIMit:LINE:SYMMetric[:COMBined]
:FREQuency<nr>:ENABle <Enable>
CONFigure:SPECtrum:SWITching:GMSK:TCH:LIMit:LINE:SYMMetric[:COMBined]
:FREQuency<nr>:ENABle <Enable>
CONFigure:SPECtrum:SWITching:EPSK:TCH:LIMit:LINE:SYMMetric[:COMBined]
:FREQuency<nr>:ENABle <Enable>
CONFigure:SPECtrum:SWITching:GMSK:CCH:LIMit:LINE:SYMMetric[:COMBined]
:FREQuency<nr>:VALue
CONFigure:SPECtrum:SWITching:GMSK:TCH:LIMit:LINE:SYMMetric[:COMBined]
:FREQuency<nr>:VALue
CONFigure:SPECtrum:SWITching:EPSK:TCH:LIMit:LINE:SYMMetric[:COMBined]
:FREQuency<nr>:VALue
<MinPwLevelRel>, <MaxPwLevelRel>, <AbsPwLevel>

Limits

<nr>	Description of parameters	Def. value	Def. unit	Unit ring
1 .. 4	Number of the measurement point	1	–	–
<Rel>	Description of parameters	Def. value	Def. unit	Unit ring
–99.9 dBc to 25 dBc	Relative limit for the measure point	see below	dBc	
<Abs>	Description of parameters	Def. value	Def. unit	Unit ring
–99.9 dBm to 40 dBm	The absolute limit for the measure point	–36	dBm	
<Enable>	Description of parameters	Def. value	Def. unit	Unit ring
ON | **OFF**	Switch on limit check Switch off limit check	ON	–	–

Description of command	Sig. State	FW vers.
These commands activate and define limit lines for the spectrum due to switching measurement.	all	V2.80

The relative limits depend on the GSM band and on the measurement points numbered by the numeric suffix <nr>.

For totally switching on or off the limit check please use the command

```
CONFigure:SPECtrum:SWITching:GMSK...:LIMit:LINE:SYMMetric[:COMBined]
:ENABle <Mode>
```

Default values for the three GSM bands (all in dBc):

Meas. point	Frequ. offset	GSM900	GSM1800	GSM1900
1	0.4 MHz	–57[6]	–50	–50
2	0.6 MHz	–67[7]	–58	–58
3	1.2 MHz	–74	–66	–66
4	1.8 MHz	–74	–66	–66

---

[6] GMSK modulation. With 8PSK modulation, the corresponding value is –52.0 dBc.

[7] GMSK modulation. With 8PSK modulation, the corresponding value is –62.0 dBc.

CONFigure:SPECtrum:SWITching:GMSK:CCH:LIMit:LINE:SYMMetric[:COMBined]:ENABle *<Mode>*
CONFigure:SPECtrum:SWITching:GMSK:TCH:LIMit:LINE:SYMMetric[:COMBined]:ENABle *<Mode>*
CONFigure:SPECtrum:SWITching:EPSK:TCH:LIMit:LINE:SYMMetric[:COMBined]:ENABle *<Mode>*

Limit Check on/off

<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
ON |	Switch on limit check	ON	–	–
OFF	Switch off limit check			

Description of command	Sig. State	FW vers.
This command switches the limit check for all measurepoints.	all	V2.80

DEFault:SPECtrum:SWITching:GMSK:CCH:LIMit:LINE *<Enable>*
DEFault:SPECtrum:SWITching:GMSK:TCH:LIMit:LINE *<Enable>*
DEFault:SPECtrum:SWITching:EPSK:TCH:LIMit:LINE *<Enable>*

Default Settings

<Enable>	Description of parameters	Def. value	Def. unit	Unit ring
ON |	All parameters are set to their default values	ON	–	
OFF	Some or all parameters differ from the default values			

Description of command	Sig. State	FW vers.
If used with *ON*, this command sets all the parameters of the subsystem to their default values. (*OFF* has no effect). In the query format, the command returns *ON* if all the parameters of the subsystem correspond to their default values, otherwise it returns *OFF*.	all	V2.80

Subsystem SPECTrum:SWITching...:MPOint<nr>

The subsystem *SPECtrum:SWITching...:MPOint<nr>* defines at which frequencies the *Spectrum* measurement is performed. The subsystem corresponds to the tab *Meas X* in the popup menu *Spectrum Configuration.*

CONFigure:SPECtrum:SWITching:GMSK:CCH:MPOint<nr>:ENABle <Enable>
CONFigure:SPECtrum:SWITching:GMSK:TCH:MPOint<nr>:ENABle <Enable>
CONFigure:SPECtrum:SWITching:EPSK:TCH:MPOint<nr>:ENABle <Enable>

Enable/Disable Measurement Points

<Enable>	Description of parameters	Def. value	Def. unit	Unit ring
ON |	Switch on measurement point <nr>	ON	–	–
OFF	Switch off measurement point <nr>			

Description of command	Sig. State	FW vers.
This command switches the measurement at the individual frequency points no. 1 to 4 (numbered by the numeric suffix <nr>) on or off.	all	V2.80

Subsystem SUBarrays:SPECtrum:SWITching

The subsystem *SUBarrays:SPECtrum:SWITching* defines the measurement range and the type of output values.

CONFigure:SUBarrays:SPECtrum:SWITching:GMSK:CCH Definition of Subarrays
CONFigure:SUBarrays:SPECtrum:SWITching:GMSK:TCH
CONFigure:SUBarrays:SPECtrum:SWITching:EPSK:TCH
<Mode>,<Start>,<Samples>{,<Start>,<Samples>}

<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
ALL | **ARIThmetical |** **MINimum |** **MAXimum,**	Return all measurement values Return arithm. mean value in every range Return minimum value in every range Return maximum value in every range	ALL	–	
<Start>	Description of parameters	Def. value	Def. unit	Unit ring
–1.8 MHz to 1.8 MHz,	Start frequency in current range	–1.8	MHz	
<Samples>	Description of parameters	Def. value	Def. unit	Unit ring
1 to 9	Number of samples in current range	9	–	

Description of command	Sig. State	FW vers.
This command configures the `READ:SUBarrays..`, `FETCh:SUBarrays..`, and `SAMPle:SUBarrays:SPECtrum:SWITching...` commands. It restricts the measurement to up to 32 subranges where either all measurement results (the number of which is given by the second numerical parameter) or a single statistical value is returned. The subranges are defined by the start frequency and the number of test points which are located at fixed frequencies (see command `CONFigure:SPECtrum:SWITching:GMSK:LIMit:LINE<nr>`). The subranges may overlap but must be within the total range of the *spectrum due to switching* measurement. Test points outside this range are not measured (result *NAN)* and do not enter into the ARIThmetical, MINimum and MAXimum values. By default, only one range corresponding to the total measurement range is used and all measurement values are returned.	all	V2.80

Measured Values

The commands of the following subsystems determine and output the results of the signal spectrum measurement. They correspond to the graphical menu *Spectrum* with its various display elements.

Subsystem SPECtrum:SWITching...

The subsystem *SPECtrum:SWITching...* measures and returns the frequency spectum (due to switching) and compares it with tolerance values. The subsystem corresponds to the graphical measurement menu *Spectrum.*

READ[:SCALar]:SPECtrum:SWITching:GMSK:CCH? Scalar Results:
READ[:SCALar]:SPECtrum:SWITching:GMSK:TCH?
READ[:SCALar]:SPECtrum:SWITching:EPSK:TCH?
Start single shot measurement and return results
FETCh[:SCALar]:SPECtrum:SWITching:GMSK:CCH?
FETCh[:SCALar]:SPECtrum:SWITching:GMSK:TCH?
FETCh[:SCALar]:SPECtrum:SWITching:EPSK:TCH?
Read measurement results (unsynchronized)
SAMPle[:SCALar]:SPECtrum:SWITching:GMSK:CCH?
SAMPle[:SCALar]:SPECtrum:SWITching:GMSK:TCH?
SAMPle[:SCALar]:SPECtrum:SWITching:EPSK:TCH?
Read measurement results (synchronized)

Return	Value range	Def. value	Def. unit	Unit ring
Reference Power,	–100.0 dBm to +20.0 dBm	NAN	dBm	
Matching	INV | MATC | NMAT | NTSC | OUT | NTRG | UFLW | OFLW	INV	–	

Description of command	Sig. State	FW vers.
These commands are always queries.	CCH TCH	V2.80

These commands are always queries.

- `READ` starts a single shot measurement and returns the results.
- `FETCh` outputs the results without taking care of the measurement state.
- `SAMPle` waits until the results are valid for the first time (depending on the chosen statistic count) and then outputs the results.

For more details refer to the description of measurement control in chapter 5 of the CMU200 operating manual.

The reference power is the absolute carrier power measured as specified in the GSM standard. The following messages may be output for the value *Matching*:

MATC	*matching*
NMAT	*not matching*
INV	*invalid*
NTSC	*no training sequence code*
OUT	*out of range*
NTRG	*not triggered*
UFLW	*underflow*
OFLW	*overflow*

READ:ARRay:SPECtrum:SWITching:GMSK:CCH? Spectrum Results
READ:ARRay:SPECtrum:SWITching:GMSK:TCH?
READ:ARRay:SPECtrum:SWITching:EPSK:TCH?
Start single shot measurement and return results
FETCh:ARRay:SPECtrum:SWITching:GMSK:CCH?
FETCh:ARRay:SPECtrum:SWITching:GMSK:TCH?
FETCh:ARRay:SPECtrum:SWITching:EPSK:TCH?
Read measurement results (unsynchronized)
SAMPle:ARRay:SPECtrum:SWITching:GMSK:CCH?
SAMPle:ARRay:SPECtrum:SWITching:GMSK:TCH?
SAMPle:ARRay:SPECtrum:SWITching:EPSK:TCH? Read results (synchronized)

Return	Description of parameters	Def. value	Def. unit	Unit ring
–100.0 dB to + 20.0 dB,	Power at measurement point 1	NAN	dBm	FG Power Level
...,	...	...	...	
–100.0 dB to + 20.0 dB	Power at measurement point 9	NAN	dBm	

Description of command	Sig. State	FW vers.
These commands are always queries. They return the off-carrier power due to switching at all measurement points.	CCH TCH	V2.80

READ:SUBarrays:SPECtrum:SWITching:GMSK:CCH? Subarray Results
READ:SUBarrays:SPECtrum:SWITching:GMSK:TCH?
READ:SUBarrays:SPECtrum:SWITching:EPSK:TCH?
Start single shot measurement and return results
FETCh:SUBarrays:SPECtrum:SWITching:GMSK:CCH?
FETCh:SUBarrays:SPECtrum:SWITching:GMSK:TCH?
FETCh:SUBarrays:SPECtrum:SWITching:EPSK:TCH?
Read measurement results (unsynchronized)
SAMPle:SUBarrays:SPECtrum:SWITching:GMSK:CCH?
SAMPle:SUBarrays:SPECtrum:SWITching:GMSK:TCH?
SAMPle:SUBarrays:SPECtrum:SWITching:EPSK:TCH? Read results (synchronized)

Ret. values per subrange	Description of parameters	Def. value	Def. unit	Unit ring
–100.0 dB to + 100.0 dB	Power at measurement point 1	NAN	dB	
...	...	...	...	
–100.0 dB to + 100.0 dB	Power at measurement point n	NAN	dB	

Description of command	Sig. State	FW vers.
These commands are always queries. They output the off-carrier power due to switching in the subranges defined by means of the `CONFigure:SUBarrays:SPECtrum:SWITching:GMSK` command. In the default setting of the configuration command the `READ:SUBarrays...`, `FETCh:SUBarrays...`, and `SAMPle:SUBarrays...` command group is equivalent to the `READ:ARRay...`, `FETCh:ARRay...`, and `SAMPle:ARRay...` command group described above. The `CONFigure:SUBarrays:SPECtrum:SWITching:GMSK` command defines a maximum of 32 subranges. If one of the statistical modes (`ARIThmetical`, `MINimum`, `MAXimum`) is set, only one value is returned per subrange.	CCH TCH	V2.80

Test Object RXQuality (Bit Error Rate Tests)

The subsystem *RXQuality* measures the BTS receiver quality. The settings are used to assess the quality of transmission between the CMU and the device under test. The subsystem corresponds to the main menu *Receiver Quality* and the associated popup menu *Receiver Quality Configuration.*

Important Note!

At present, RXQuality tests assume GMSK-modulated signals.

Test Configuration – Subsystem RXQuality:CONTrol

The subsystem *RXQuality:CONTrol* controls all receiver quality measurements.

CONFigure:RXQuality:CONTrol:HTIMe <AGCTime>, <*SynchTime*>			AGC/Sync. Holdoff Time	
<value>	Description of parameters	Def. value	Def. Unit	Unit ring
0 s to 100 s	Automatic gain control	3.0	s	
<value>	Description of parameters	Def. value	Def. Unit	Unit ring
0 s to 100 s	Bit stream synchronization	3.0	s	
Description of command			Sig. State	FW vers.
This command defines hold off times during which the mobile can adapt itself to the new RF level at the beginning of the receiver quality measurement and send back the bit stream received. By reducing the hold off times, the measurement can be speeded up. The default settings for both times do not depend on the application.				1.0

Test Object RXQuality:BER

The subsystem *RXQuality:BER* measures the receiver quality in the single shot mode. The subsystem corresponds to the main menu *Receiver Quality,* Application *BER* and the corresponding parts of the associated popup menu *Receiver Quality Configuration.*

Control of Measurement – Subsystem RXQuality:BER

The subsystem *RXQuality:BER* controls the single shot receiver quality measurements.

CONFigure:RXQuality:BER:TSETup <*Testsetup*> Test Setup

<Application>	Description of parameters	Def. value	Def. unit	Unit ring
T1 | **T2 |** **...** **T10**	Single Shot Test Setup 1 ... Single Shot Test Setup 10	T1	–	–

Description of command	Sig. State	FW vers.
This command selects one out of 10 data sets as application, enabling 10 different Receiver Quality Single Shot measurements that can be parameterized. When an application is switched over, the running measurement is stopped and all measured values are set invalid.	CEST	1.0

INITiate:RXQuality:BER	Start new measurement	⇒ *RUN*
ABORt:RXQuality:BER	Abort running measurement and switch off	⇒ *OFF*
STOP:RXQuality:BER	Stop measurement	⇒ *STOP*
CONTinue:RXQuality:BER	Next measurement step (only *stepping mode*)	⇒ *RUN*

Description of command	Sig. State	FW vers.
These commands do not exist as queries. They start or stop one the selected Single Shot measurement, setting it to the status indicated in the top right column.	all	1.0

CONFigure:RXQuality:BER:EREPorting <*Mode*> Event Reporting

<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
SRQ | **SOPC |** **SRSQ |** **OFF**	Service request Single operation complete SRQ and SOPC No reporting	OFF	–	–

Description of command	Sig. State	FW vers.
This command defines the events generated when the measurement is terminated or stopped *(event reporting,* see chapter 5).	all	1.0

FETCh:RXQuality:BER:STATus? Measurement Status

Return	Description of parameters	Def. value	Def. unit	Unit ring
OFF |	Measurement in the *OFF* state (`*RST` or `ABORt`)	OFF	–	–
RUN |	Running (after `INITiate, CONTinue` or `READ`)			
STOP |	Stopped (`STOP`)			
ERR |	*OFF* (could not be started)			
STEP |	Stepping mode *(<stepmode>=STEP)*			
RDY,	Stopped according to repetition mode and stop condition			
1 to 50000 |	Counter for current evaluation period within a cycle			
NONE	Statistic count set to off	NONE	–	–

Description of command	Sig. State	FW vers.
This command is always a query. It returns the status of the measurement (see chapter 5).	all	1.0

Subsystem RXQuality:BER:CONTrol

The subsystem *RXQuality:BER:CONTrol* sets the parameters for the single shot *Receiver Quality* measurement. The subsystem corresponds to the tab *Control* in the popup menu *Receiver Quality Configuration.*

CONFigure:RXQuality:BER<nr>:CONTrol *<Mode>, <FramesToSend>* Frames

<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
RFER |	Residual bit error rate, FER	RFER	–	
BER	Bit error rate			
BBB	Burst by burst			
<FramesToSend>	**Description of parameters**	**Def. value**	**Def. unit**	**Unit ring**
1 to 50000 |	No. of frames to be sent in single shot mode	See below	–	
NONE	No average (only 1 frame considered)			

Description of command	Sig. State	FW vers.
This command defines the measured value and the number of frames to be sent in a single shot measurement, constituting a statistics cycle. The suffix <nr> numbers the test setup (<nr> = 1 to 10, see command `CONFigure:RXQuality:BER:TSETup`). For a definition of the measured values (BER, RBER etc.) see chapter 4. The following default settings are valid for the command parameters:	all	1.0

Test setup	1	2	3	4	5	6	7	8	9	10
Mode	BER	BER	BER	BER	BER	BER	BER	BER	BER	BER
Frames	100	100	500	500	100	500	500	100	100	100

CONFigure:RXQuality:BER<nr>:CONTrol:REPetition *<StopCondition>* ,<Stepmode> Test Cycles

<StopCondition>	Description of parameters	Def. value	Def. unit	Unit ring
ALIMits |	Measurement aborted when all permissible limit values are violated	See below	–	–
FLIMit |	Aborted when first limit value is violated			
NONE	Not aborted, measurement over all frames			

<Stepmode>	Description of parameters	Def. value	Def. unit	Unit ring
STEP |	Interrupt measurement after each statistics cycle	NONE	–	–
NONE	Continue measurement according to its rep. mode			

Description of command	Sig. State	FW vers.
This command determines the stop condition and the stepping mode for the measurement. The suffix <nr> numbers the test setup (<nr> = 1 to 10, see command `CONFigure:RXQuality:BER:TSETup`). Depending on the application, the following default settings are valid:	all	1.0

Test setup	1	2	3	4	5	6	7	8	9	10
StopCond	FLIM	FLIM	FLIM	FLIM	FLIM	FLIM	FLIM	FLIM	FLIM	FLIM

CONFigure:RXQuality:BER<nr>:CONTrol[:TCH]:LEVel:UTIMeslot *<Level>*

TCH BER Level, Used Timeslot

<Level>	Description of parameters	Def. value	Def. unit	Unit ring
–137 dBm to –27 dBm	RF1 level in used timeslot	See below	dBm	Power level
–137 dBm to –10 dBm	RF2 level in used timeslot			
–90 dBm to +13 dBm	RF3 OUT level in used timeslot			

Description of command	Sig. State	FW vers.
This command defines the absolute level of the traffic channel (*TCH*) in the used timeslot for the single shot receiver quality measurement.	all	1.0

This level applies to the Receiver Quality measurement only. The default setting depends on the test setup (<nr> = 1 to 10; all level values in dBm):

Test setup	1	2	3	4	5	6	7	8	9	10
Level	–102.0	–104.0	–102.0	–104.0	–100.0	–100.0	–100.0	–102.0	–102.0	–102.0

CONFigure:RXQuality:BER<nr>:CONTrol[:TCH]:LEVel:UNTimeslot *<Level>*

TCH BER Level, Unused Timeslot

<Level>	Description of parameters	Def. value	Def. unit	Unit ring
–127 dB to +127 dB	Level in unused timeslot	see below	dB	Ratio

Description of command	Sig. State	FW vers.
This command defines the relative level of the traffic channel (*TCH*) in the unused timeslot for the single shot receiver quality measurement.	all	1.0

This level applies to the *receiver quality* measurement only. The value range mentioned above is valid with the restriction that the sum of the absolute level of the used timeslot and the relative value for the unused timeslot does not exceed the value ranges for the absolute level of the used timeslot (for RF 1, RF 2 and RF 3 OUT).The default setting depends on the test setup (<nr> = 1 to 10; all level values in dB):

Test setup	1	2	3	4	5	6	7	8	9	10
Level	–18.0	–16.0	–18.0	–16.0	–20.0	–20.0	–20.0	–18.0	–18.0	–20.0

DEFault:RXQuality:BER<nr>:CONTrol <Enable> Default Settings

<Enable>	Description of parameters	Def. value	Def. unit	Unit ring
ON | **OFF**	All parameters are set to their default values Some or all parameters differ from the default values	ON	–	
Description of command			Sig. State	FW vers.
If used with *ON*, this command sets all the parameters of the subsystem to their default values. (*OFF* has no effect). In the query format, the command returns *ON* if all the parameters of the subsystem correspond to their default values, otherwise it returns *OFF*.			all	1.0

Subsystem RXQuality:BER<nr>:LIMit

The subsystem *RXQuality:BER<nr>:LIMit* defines tolerance values for the single shot receiver quality measurements. The subsystem corresponds to the tab *Limits* in the popup menu *Sensitivity Configuration.*

CONFigure:RXQuality:BER<nr>:LIMit:CLII <*ClassIIBER*> Class II Bits

<ClassIIBER>	Description of parameters	Def. value	Def. unit	Unit ring
0 % to 100 %	Upper limit of error rate for class II bits	2	%	Ratio
Description of command			Sig. State	FW vers.
This command defines an upper limit for the bit error rate of class II (unprotected bits, see chapter 4) for the current test setup (<nr> = 1 to 10). Irrespective of the test setup, the default setting is 2 %.				1.0

CONFigure:RXQuality:BER<nr>:LIMit:CLIB <*ClassIbBER*> Class Ib Bits

<ClassIbBER>	Description of parameters	Def. value	Def. unit	Unit ring
0 % to 100 %	Upper limit of error rate for class Ib bits	0.4	%	Ratio
Description of command			Sig. State	FW vers.
This command defines an upper limit for the bit error rate of class IB (partly protected bits, see chapter 4) for the current test setup (<nr> = 1 to 10). Irrespective of the test setup, the default setting is 0.4 %.				1.0

CONFigure:RXQuality:BER<nr>:LIMit:FERRors <Frame Errors> Frame Errors

<FERRors>	Description of parameters	Def. value	Def. unit	Unit ring
0 % to 100 %	Upper limit for erased frame errors	0.1	%	Ratio
Description of command			Sig. State	FW vers.
This command defines an upper limit for frame errors for the current test setup (<nr> = 1 to 10) . Irrespective of the test setup, the default setting is 0.1 %.				1.0

DEFault:RXQuality:BER<nr>:LIMit Default Settings

<Enable>	Description of parameters	Def. value	Def. unit	Unit ring
ON |	All parameters are set to their default values	ON	–	
OFF	Some or all parameters differ from the default values			

Description of command	Sig. State	FW vers.
If used with *ON*, this command sets all the parameters of the subsystem to their default values. (*OFF* has no effect). In the query format, the command returns *ON* if all the parameters of the subsystem correspond to their default values, otherwise it returns *OFF*.	all	1.0

Measured Values – Subsystem RXQuality:BER

The subsystem *RXQuality:BER* measures the bit error rate and compares it with the tolerance values. The subsystem corresponds to the measurement menus *Receiver Quality* in the *BER* application.

Scalar Results:

READ[:SCALar]:RXQuality:BER?	Start single shot measurement and return results
FETCh[:SCALar]:RXQuality:BER?	Read out meas. results (unsynchronized)
SAMPle[:SCALar]:RXQuality:BER?	Read out measurement results (synchronized)

Return for RFER	Value range	Def. value	Def. unit	Unit ring
ProgressTime,	0.0 to 100.0 %	NAN	%	
ClassIIBits,	0.000 to 100.000 %	NAN	%	
ClassIbBits,	0.000 to 100.000 %	NAN	%	
FER,	0.000 to 100.000 %	NAN	%	
CRCErrors,	1 to 50000	NAN	–	
Status	INV | PASS | FAIL | TMER | IMP	INV	–	

Return for BER	Value range	Def. value	Def. unit	Unit ring
ProgressTime,	0.0 to 100.0 %	NAN	%	
ClassIIBits,	0.000 to 100.000 %	NAN	%	
ClassIbBits,	0.000 to 100.000 %	NAN	%	
CRCErrors,	1 to 50000	NAN	–	
Status	INV | PASS | FAIL | TMER | IMP	INV	–	

Description of command	Sig. State	FW vers.
These commands are always queries. They start a bit-error-rate test in the single shot repetition mode and output the measurement results (see also detailed explanation of measured values in chapter 4). The results depend on the measurement mode set via the `CONFigure:RXQuality:BER<nr> :CONTrol` command (RFER, BER, or BBB). They are	all	1.0

ProgressTime	Relative progress of the measurement
ClassIIBits	(Residual) bit error rate for class II bits
ClassIbBits	(Residual) bit error rate for class Ib bits
FER	Frame erasure rate
CRCErrors	Cyclic redundancy check (CRC) errors
Status	Measurement status

The following messages can be output for the measurement status:

INV	Measurement invalid	*invalid*
PASS	all tolerances matched	*passed*
FAIL	Not all tolerances matched	*failed*
TMER	CMU could not synchronize	*too many errors*
IMP	Measurement impossible, therefore invalid	*impossible*

CALCulate:RXQuality:BER:MATChing:LIMit? Limit Matching

Return for RFER	Value range	Def. value	Def. unit	Unit ring
Total,	**PASS | FAIL | INV | TMER | IMP**	INV	–	
ClassIIBits,	**NMAU | INV | OK**	INV	–	
ClassIbBits,	**NMAU | INV | OK**	INV	–	
FER,	**NMAU | INV | OK**	INV	–	
CRCErrors	**NMAU | INV | OK**	INV	–	

Return for BER	Value range	Def. value	Def. unit	Unit ring
Total,	**PASS | FAIL | INV | TMER | IMP**	INV	–	
ClassIIBits,	**NMAU | INV | OK**	INV	–	
ClassIbBits,	**NMAU | INV | OK**	INV	–	
CRC	**NMAU | INV | OK**	INV	–	

Description of command	Sig. State	FW vers.
This command is always a query. It indicates whether and in which way the permissible error limits for the measured values of the bit error rate test (see command above) have been exceeded.	all	1.0

The following messages can be output for the measured quantities:

PASS	all tolerances matched	*passed*
FAIL	Not all tolerances matched	*failed*
INV	Invalid measurement	*invalid*
TMER	CMU could not synchronize	*too many errors*
IMP	Measurement impossible, therefore invalid	*impossible*
NMAU	Tolerance exceeded	*not matching, underflow*
INV	Invalid measurement	*invalid*
OK	all tolerances matched	

Test Object RXQuality:BAVerage

The subsystem *RXQuality:BAVerage* contains the commands for continuous receiver quality measurement. The subsystem corresponds to the main menu *Receiver Quality,* Application Continuous and the corresponding parts of the associated popup menu *Receiver Quality Configuration.*

Control of Measurement – Subsystem RXQuality:BAVerage

The subsystem *RXQuality:BAVerage* controls the Continuous measurement.

INITiate:RXQuality:BAVerage	Start new measurement		*⇒ RUN*
ABORt:RXQuality:BAVerage	Abort running measurement and switch off		*⇒ OFF*
STOP:RXQuality:BAVerage	Stop measurement		*⇒ STOP*
CONTinue:RXQuality:BAVerage	Next measurement step (only *stepping mode*)		*⇒ RUN*
Description of command		Sig. State	FW vers.
These commands do not exist as queries. They start or stop the Continuous measurement, setting it to the status indicated in the top right column.		all	1.0

CONFigure: RXQuality:BAVerage:EREPorting <*Mode*>				Event Reporting
<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
SRQ | **SOPC |** **SRSQ |** **OFF**	Service request Single operation complete SRQ and SOPC No reporting	OFF	–	–
Description of command			Sig. State	FW vers.
This command defines the events generated when the measurement is terminated or stopped *(event reporting,* see chapter 5).			all	1.0

FETCh:RXQuality:BAVerage:STATus?				Measurement Status
Return	Description of parameters	Def. value	Def. unit	Unit ring
OFF | **RUN |** **STOP |** **ERR |** **STEP |** **RDY,**	Measurement in the *OFF* state (`*RST` or `ABORt`) Running (after `INITiate`, `CONTinue` or `READ`) Stopped (`STOP`) *OFF* (could not be started) Stepping mode *(<stepmode>=STEP)* Stopped according to repetition mode and stop condition	OFF	–	–
1 to 500 | **NONE**	Counter for current evaluation period within a cycle Statistic count set to off	NONE	–	–
Description of command			Sig. State	FW vers.
This command is always a query. It returns the status of the measurement (see chapter 5).			all	1.0

Subsystem RXQuality:BAVerage:CONTrol

The subsystem *RXQuality:BAVerage:CONTrol* sets the parameters for the continuous receiver quality measurement. The subsystem corresponds to the tab *Control* in the popup menu *Receiver Quality Configuration.*

CONFigure:RXQuality:BAVerage:CONTrol <*Mode*>, <*FramesToAverage*> Average

<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
RFER | **BER**	Residual bit error rate, FER Bit error rate	BER	–	
<FramesToAverage>	Description of parameters	Def. value	Def. unit	Unit ring
1 to 500 | **NONE**	No. of frames to be averaged No average (only 1 frame considered)	100	–	

Description of command	Sig. State	FW vers.
This command defines the measured value and the number of frames to be averaged in the continuous measurement, constituting a statistics cycle. For definition of the measured value (BER, RBER etc.) see chapter 4.	all	1.0

CONFigure:RXQuality:BAVerage:CONTrol:REPetition <*StopCondition*> ,<Stepmode> Test Cycles

<StopCondition>	Description of parameters	Def. value	Def. Unit	Unit ring
ALIMits | **FLIMit |** **NONE**	Measurement aborted when all permissible limit values are violated Aborted when first limit value is violated Not aborted, measurement over all frames	FLIM	–	–
<Stepmode>	Description of parameters	Def. value	Def. Unit	Unit ring
STEP | **NONE**	Interrupt measurement after each statistics cycle Continue measurement according to its rep. mode	NONE	–	–

Description of command	Sig. State	FW vers.
This command determines the stop condition and the stepping mode for the measurement. In search mode, an RF level that leads to a particular bit error rate is repeatedly determined.	all	1.0

CONFigure:RXQuality:BAVerage:CONTrol[:TCH]:LEVel:UTIMeslot <*Level*> TCH BER Level, Used Timeslot

<Level>	Description of parameters	Def. value	Def. unit	Unit ring
–137 dBm to –27 dBm **–137 dBm to –10 dBm** **–90 dBm to +13 dBm**	RF1 level in used timeslot RF2 level in used timeslot RF 3 OUT level in used timeslot	- 102.0	dBm	Power level

Description of command	Sig. State	FW vers.
This command defines the absolute level of the traffic channel (*TCH*) in the used timeslot for the continuous application. This level applies to the *Sensitivity* measurement only.	all	1.0

CONFigure:RXQuality:BAVerage:CONTrol[:TCH]:LEVel:UNTimeslot <*Level*>

TCH BER Level, Unused Timeslot

<*Level*>	Description of parameters	Def. value	Def. unit	Unit ring
–127 dB to +127 dB	Level in unused timeslot	- 18.0	dB	Ratio

Description of command	Sig. State	FW vers.
This command defines the relative level of the traffic channel (*TCH*) in the unused timeslot for the continuous application. This level applies to the Sensitivity measurement only. The value range mentioned above is valid with the restriction that the sum of the absolute level of the used timeslot and the relative value for the unused timeslot does not exceed the value ranges for the absolute level of the used timeslot (for RF 1, RF 2 and RF 3 OUT).	all	1.0

DEFault:RXQuality:BAVerage:CONTrol

Default Settings

<*Enable*>	Description of parameters	Def. value	Def. unit	Unit ring
ON | **OFF**	All parameters are set to their default values Some or all parameters differ from the default values	ON	–	

Description of command	Sig. State	FW vers.
As a *setting command* with the setting *ON* this command sets all parameters of the subsystem to default values (the setting *OFF* has no effect). As a query, this command reads out whether all parameters are set to default values *(ON)* or not *(OFF)*.	all	1.0

Subsystem RXQuality:BAVerage:LIMit

The subsystem *RXQuality:BAVeraget:LIMit* defines tolerance values for the continuous receiver quality measurement. The subsystem corresponds to the tab *Limits* in the popup menu *Receiver Quality Configuration.*

CONFigure:RXQuality:BAVerage:LIMit:CLII <*ClassIIBER*>

Class II Bits

<*ClassIIBER*>	Description of parameters	Def. value	Def. unit	Unit ring
0 % to 100 %	Upper limit of error rate for class II bits	2	%	Ratio

Description of command	Sig. State	FW vers.
This command defines an upper limit for the bit error rate of class II (unprotected bits, see chapter 4) for continuous application.		1.0

CONFigure:RXQuality:BAVerage:LIMit:CLIB <*ClassIbBER*>

Class Ib Bits

<*ClassIbBER*>	Description of parameters	Def. value	Def. unit	Unit ring
0 % to 100 %	Upper limit of error rate for class Ib bits	0.4	%	Ratio

Description of command	Sig. State	FW vers.
This command defines an upper limit for the bit error rate of class IB (partly protected bits, see chapter 4) for the continuous application.		1.0

CONFigure:RXQuality:BAVerage:LIMit:FERRors <Frame Errors> Frame Errors

<FERRors>	Description of parameters	Def. value	Def. unit	Unit ring
0 % to 100 %	Upper limit for erased frame errors	0.1	%	Ratio
Description of command			Sig. State	FW vers.
This command defines an upper limit for the relative portion of invalid and therefore erased frames (*frame erasure rate*, see chapter 4) in the measurement of the residual bit error rate (*RBER*, see command `CONFigure:RXQuality:BAVerage:CONTrol`) and for the continuous application.				1.0

DEFault:RXQuality:BAVerage:LIMit
Default Settings

<Enable>	Description of parameters	Def. value	Def. unit	Unit ring
ON |	All parameters are set to their default values	ON	–	
OFF	Some or all parameters differ from the default values			
Description of command			Sig. State	FW vers.
If used with *ON*, this command sets all the parameters of the subsystem to their default values. (*OFF* has no effect). In the query format, the command returns *ON* if all the parameters of the subsystem correspond to their default values, otherwise it returns *OFF*.			all	1.0

Measured Values – Subsystem RXQuality:BAVerage

The subsystem *RXQuality:BAVerage* measures the bit error rate and compares it with the tolerance values. The subsystem corresponds to the measurement menus *Receiver Quality* for the single shot type of measurement and measured values *(RBERFER, BER, BurstByBurst, RBERUFR, RBERESIDR, RBEREVSIDR)*.

Scalar Results:

READ[:SCALar]:RXQuality:BAVerage? Start single shot measurement and return results
FETCh[:SCALar]: RXQuality:BAVerage? Read out meas. results (unsynchronized)
SAMPle[:SCALar]: RXQuality:BAVerage? Read out measurement results (synchronized)

Return for RFER	Value range	Def. value	Def. unit	Unit ring
ProgressTime,	0.0 to 100.0 %	NAN	%	
ClassIIBits,	0.000 to 100.000 %	NAN	%	
ClassIbBits,	0.000 to 100.000 %	NAN	%	
FER,	0.000 to 100.000 %	NAN	%	
CRCErrors,	1 to 500	NAN	–	
Status	INV | PASS | FAIL | TMER | IMP	INV	–	
Return for BER	Value range	Def. value	Def. unit	Unit ring
ProgressTime,	0.0 to 100.0 %	NAN	%	
ClassIIBits,	0.000 to 100.000 %	NAN	%	
ClassIbBits,	0.000 to 100.000 %	NAN	%	
CRCErrors,	1 to 500	NAN	–	
Status	INV | PASS | FAIL | TMER | IMP	INV	–	

Description of command	Sig. State	FW vers.
These commands are always queries. They start a bit-error-rate test in the continuous repetition mode and output the measurement results (see also detailed explanation of measured values in chapter 4). These are	all	1.0

ProgressTime	Relative progress of the measurement
ClassIIBits	(Residual) bit error rate for class II bits
ClassIbBits	(Residual) bit error rate for class Ib bits
FER	Frame erasure rate
CRCErrors	Cyclic redundancy check (CRC) errors
Status	Measurement status

The following messages can be output for the measurement status:

INV	Measurement invalid	*invalid*
PASS	all tolerances matched	*passed*
FAIL	Not all tolerances matched	*failed*
TMER	CMU could not synchronize	*too many errors*
IMP	Measurement impossible, therefore invalid	*impossible*

CALCulate:RXQuality:BAVerage:MATChing:LIMit? Limit Matching

Return for RFER	Value range	Def. value	Def. unit	Unit ring
Total,	**PASS | FAIL | INV | TMER | IMP**	INV	–	
ClassIIBits,	**NMAU | INV | OK**	INV	–	
ClassIbBits,	**NMAU | INV | OK**	INV	–	
FER,	**NMAU | INV | OK**	INV	–	
CRCErrors	**NMAU | INV | OK**	INV	–	

Return for BER	Value range	Def. value	Def. unit	Unit ring
Total,	**PASS | FAIL | INV | TMER | IMP**	INV	–	
ClassIIBits,	**NMAU | INV | OK**	INV	–	
ClassIbBits,	**NMAU | INV | OK**	INV	–	
CRC	**NMAU | INV | OK**	INV	–	

Description of command	Sig. State	FW vers.
This command is always a query. It indicates whether and in which way the permissible error limits for the measured values of the bit error rate test (see command above) have been exceeded. The following messages can be output for the measured quantities:	all	1.0

PASS	all tolerances matched	*passed*
FAIL	Not all tolerances matched	*failed*
INV	Invalid measurement	*invalid*
TMER	CMU could not synchronize	*too many errors*
IMP	Measurement impossible, therefore invalid	*impossible*
NMAU	Tolerance exceeded	*not matching, underflow*
INV	Invalid measurement	*invalid*
OK	all tolerances matched	

List of Commands

In the following, all remote-control commands of the function group GSM900-BTS implemented in the CMU will be listed with their parameters and page numbers. They are arranged alphabetically according to the **second** keyword of the command so that related commands belong to the same group. The commands for the operating modes with and without signalling are listed separately.

Commands for GSM Measurements without Signalling

Table 6-1 Remote-control commands: Non Signalling

Command	Parameter	Remark	Page
Inputs and outputs			
[SENSe:]CORRection:LOSS:INPut<nr>[:MAGNitude]	–50 dB to +50 dB	with query	6.8
SOURce:CORRection:LOSS:INPut<nr>[:MAGNitude]	–50 dB to +50 dB	with query	6.8
[SENSe:]CORRection:LOSS:Output<nr>[:MAGNitude]	–50 dB to 50 dB	with query	6.8
SOURce:CORRection:LOSS:OUTPut<nr>[:MAGNitude]	–50 dB to 50 dB	with query	6.8
SOURce:DM:CLOCk:FREQuency	<Frequency>	with query	6.9
SOURce:DM:CLOCk:STATe	ON | OFF	with query	6.9
INPut[:STATe]	RF1 | RF2 | RF4	with query	6.8
OUTPut[:STATe]	RF1 | RF2 | RF3	with query	6.8
Expected power			
DEFault:EPOWer	ON | OFF	with query	6.2
[SENSe:]EPOWer:ATTenuation	NORMal | LNOise | LDIStortion	with query	6.2
[SENSe:]EPOWer:MAXimum	<Power>	with query	6.2
[SENSe:]EPOWer:MODE	MANual | AUTO	with query	6.1
Modulation measurement			
INITiate:MODulation:EVMagnitude:EPSK	–	no query	6.38
ABORt:MODulation:EVMagnitude:EPSK	–	no query	6.38
STOP:MODulation:EVMagnitude:EPSK	–	no query	6.38
CONTinue:MODulation:EVMagnitude:EPSK	–	no query	6.38
CONFigure:SUBarrays:MODulation:EVMagnitude:EPSK	ALL | ARIThmetical | MINimum | MAXimum,<Start>,<Samples>{,<Start>,<Samples>}	with query	6.41

Command	Parameter	Remark	Page
READ:ARRAy:MODulation:EVMagnitude:EPSK:AVERage?	–100.0 dB to +100.0 dB	query only	6.43
FETCh:ARRAy:MODulation:EVMagnitude:EPSK:AVERage?	–100.0 dB to +100.0 dB	query only	6.43
SAMPle:ARRAy:MODulation:EVMagnitude:EPSK:AVERage?	–100.0 dB to +100.0 dB	query only	6.43
READ:SUBarrays:MODulation:EVMagnitude:EPSK:AVERage?	–100.0 dB to +20.0 dB	query only	6.43
FETCh:SUBarrays:MODulation:EVMagnitude:EPSK:AVERage?	–100.0 dB to +20.0 dB	query only	6.43
SAMPle:SUBarrays:MODulation:EVMagnitude:EPSK:AVERage?	–100.0 dB to +20.0 dB	query only	6.43
CONFigure:MODulation:EVMagnitude:EPSK:CONTrol	SCALar | ARRay, 1 to 1000 | NONE, CONTinuous | SINGleshot | 1 to 10000, SOERror | NONE,STEP | NONE	with query	6.39
DEFault:MODulation:EVMagnitude:EPSK:CONTrol	ON | OFF	with query	6.41
CONFigure:MODulation:EVMagnitude:EPSK:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SOERror | NONE, STEP | NONE	with query	6.40
CONFigure:MODulation:EVMagnitude:EPSK:CONTrol:RMODe	SCALar | ARRay	with query	6.40
CONFigure:MODulation:EVMagnitude:EPSK:CONTrol:STATistics	1 to 1000 | NONE	with query	6.40
READ:ARRAy:MODulation:EVMagnitude:EPSK:CURRent?	–100.0 dB to +100.0 dB	query only	6.43
FETCh:ARRAy:MODulation:EVMagnitude:EPSK:CURRent?	–100.0 dB to +100.0 dB	query only	6.43
SAMPle:ARRAy:MODulation:EVMagnitude:EPSK:CURRent?	–100.0 dB to +100.0 dB	query only	6.43
READ:SUBarrays:MODulation:EVMagnitude:EPSK:CURRent?	–100.0 dB to +20.0 dB	query only	6.43
FETCh:SUBarrays:MODulation:EVMagnitude:EPSK:CURRent?	–100.0 dB to +20.0 dB	query only	6.43
SAMPle:SUBarrays:MODulation:EVMagnitude:EPSK:CURRent?	–100.0 dB to +20.0 dB	query only	6.43
CONFigure:MODulation:EVMagnitude:EPSK:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.38
CALCulate[:SCALar]:MODulation:EVMagnitude:EPSK:MATChing:LIMit?	<Result>	query only	6.42
READ:ARRAy:MODulation:EVMagnitude:EPSK:MMAXimum?	–100.0 dB to +100.0 dB	query only	6.43
FETCh:ARRAy:MODulation:EVMagnitude:EPSK:MMAXimum?	–100.0 dB to +100.0 dB	query only	6.43
SAMPle:ARRAy:MODulation:EVMagnitude:EPSK:MMAXimu	–100.0 dB to +100.0 dB	query only	6.43

Command	Parameter	Remark	Page
m?			
READ:SUBarrays:MODulation:EVMagnitude:EPSK:MMAXimum?	–100.0 dB to +20.0 dB	query only	6.43
FETCh:SUBarrays:MODulation:EVMagnitude:EPSK:MMAXimum?	–100.0 dB to +20.0 dB	query only	6.43
SAMPle:SUBarrays:MODulation:EVMagnitude:EPSK:MMAXimum?	–100.0 dB to +20.0 dB	query only	6.43
FETCh:MODulation:EVMagnitude:EPSK:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE , 1 to 1000 | NONE	query only	6.39
READ[:SCALar]:MODulation:EVMagnitude:EPSK?	<Result>	query only	6.42
FETCh[:SCALar]:MODulation:EVMagnitude:EPSK?	<Result>	query only	6.42
SAMPle[:SCALar]:MODulation:EVMagnitude:EPSK?	<Result>	query only	6.42
INITiate:MODulation:MERRor:EPSK	–	no query	6.52
ABORt:MODulation:MERRor:EPSK	–	no query	6.52
STOP:MODulation:MERRor:EPSK	–	no query	6.52
CONTinue:MODulation:MERRor:EPSK	–	no query	6.52
CONFigure:SUBarrays:MODulation:MERRor:EPSK	ALL | ARIThmetical | MINimum | MAXimum,<Start>,<Samples>{,<Start>,<Samples>}	with query	6.55
READ:ARRAy:MODulation:MERRor:EPSK:AVERage?	–100.0 dB to +100.0 dB	query only	6.57
FETCh:ARRAy:MODulation:MERRor:EPSK:AVERage?	–100.0 dB to +100.0 dB	query only	6.57
SAMPle:ARRAy:MODulation:MERRor:EPSK:AVERage?	–100.0 dB to +100.0 dB	query only	6.57
READ:SUBarrays:MODulation:MERRor:EPSK:AVERage?	–100.0 dB to +20.0 dB	query only	6.57
FETCh:SUBarrays:MODulation:MERRor:EPSK:AVERage?	–100.0 dB to +20.0 dB	query only	6.57
SAMPle:SUBarrays:MODulation:MERRor:EPSK:AVERage?	–100.0 dB to +20.0 dB	query only	6.57
CONFigure:MODulation:MERRor:EPSK:CONTrol	SCALar | ARRay, 1 to 1000 | NONE, CONTinuous | SINGleshot | 1 to 10000, SOERror | NONE,STEP | NONE	with query	6.53
DEFault:MODulation:MERRor:EPSK:CONTrol	ON | OFF	with query	6.54
CONFigure:MODulation:MERRor:EPSK:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SOERror | NONE, STEP | NONE	with query	6.54
CONFigure:MODulation:MERRor:EPSK:CONTrol:RMODe	SCALar | ARRay	with query	6.54
CONFigure:MODulation:MERRor:EPSK:CONTrol:STATistics	1 to 1000 | NONE	with query	6.54

Command	Parameter	Remark	Page
READ:ARRAy:MODulation:MERRor:EPSK:CURRent?	–100.0 dB to +100.0 dB	query only	6.57
FETCh:ARRAy:MODulation:MERRor:EPSK:CURRent?	–100.0 dB to +100.0 dB	query only	6.57
SAMPle:ARRAy:MODulation:MERRor:EPSK:CURRent?	–100.0 dB to +100.0 dB	query only	6.57
READ:SUBarrays:MODulation:MERRor:EPSK:CURRent?	–100.0 dB to +20.0 dB	query only	6.57
FETCh:SUBarrays:MODulation:MERRor:EPSK:CURRent?	–100.0 dB to +20.0 dB	query only	6.57
SAMPle:SUBarrays:MODulation:MERRor:EPSK:CURRent?	–100.0 dB to +20.0 dB	query only	6.57
CONFigure:MODulation:MERRor:EPSK:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.52
CALCulate[:SCALar]:MODulation:MERRor:EPSK:MATChing:LIMit?	<Result>	query only	6.56
READ:ARRAy:MODulation:MERRor:EPSK:MMAXimum?	–100.0 dB to +100.0 dB	query only	6.57
FETCh:ARRAy:MODulation:MERRor:EPSK:MMAXimum?	–100.0 dB to +100.0 dB	query only	6.57
SAMPle:ARRAy:MODulation:MERRor:EPSK:MMAXimum?	–100.0 dB to +100.0 dB	query only	6.57
READ:SUBarrays:MODulation:MERRor:EPSK:MMAXimum?	–100.0 dB to +20.0 dB	query only	6.57
FETCh:SUBarrays:MODulation:MERRor:EPSK:MMAXimum?	–100.0 dB to +20.0 dB	query only	6.57
SAMPle:SUBarrays:MODulation:MERRor:EPSK:MMAXimum?	–100.0 dB to +20.0 dB	query only	6.57
FETCh:MODulation:MERRor:EPSK:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE , 1 to 1000 | NONE	query only	6.53
READ[:SCALar]:MODulation:MERRor:EPSK?	<Result>	query only	6.56
FETCh[:SCALar]:MODulation:MERRor:EPSK?	<Result>	query only	6.56
SAMPle[:SCALar]:MODulation:MERRor:EPSK?	<Result>	query only	6.56
CONFigure:MODulation:OEMP:EPSK:AVERage:LIMit[:SCALar]:SYMMetric[:COMBined]	<EVMErrorPeak>, <EVMErrorRMS>, <MagnErrorPeak>, <MagnErrorRMS>, <PhaseErrorPeak>, <PhaseErrorRMS>, <OriginOffset>, <IQImbalance>, <FreqError>	with query	6.35
CONFigure:MODulation:OEMP:EPSK:CMMax:LIMit[:SCALar]:SYMMetric[:COMBined]	<EVMErrorPeak>, <EVMErrorRMS>, <MagnErrorPeak>, <MagnErrorRMS>, <PhaseErrorPeak>, <PhaseErrorRMS>, <OriginOffset>, <IQImbalance>, <FreqError>	with query	6.35
DEFault:MODulation:OEMP:EPSK:LIMit	ON | OFF	with query	6.36
CONFigure:MODulation:OEMP:EPSK:P95th:LIMit[:SCALar]:SYMMetric[:COMBined]	<EVM95%>, <MError95%>, <PError95%>	with query	6.36

Command	Parameter	Remark	Page
INITiate:MODulation:OVERview:EPSK	–	no query	6.32
ABORt:MODulation:OVERview:EPSK	–	no query	6.32
STOP:MODulation:OVERview:EPSK	–	no query	6.32
CONTinue:MODulation:OVERview:EPSK	–	no query	6.32
CONFigure:MODulation:OVERview:EPSK:CONTrol	SCALar | ARRay, 1 to 1000 | NONE, CONTinuous | SINGleshot | 1 to 10000, SOERror | NONE,STEP | NONE	with query	6.33
DEFault:MODulation:OVERview:EPSK:CONTrol	ON | OFF	with query	6.35
CONFigure:MODulation:OVERview:EPSK:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SOERror | NONE, STEP | NONE	with query	6.34
CONFigure:MODulation:OVERview:EPSK:CONTrol:RMODe	SCALar | ARRay	with query	6.34
CONFigure:MODulation:OVERview:EPSK:CONTrol:STATistics	1 to 1000 | NONE	with query	6.34
CONFigure:MODulation:OVERview:EPSK:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.32
CALCulate[:SCALar]:MODulation:OVERview:EPSK:MATChing:LIMit?	<Result>	query only	6.37
FETCh:MODulation:OVERview:EPSK:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE , 1 to 1000 | NONE	query only	6.33
READ[:SCALar]:MODulation:OVERview:EPSK?	<Result>	query only	6.36
FETCh[:SCALar]:MODulation:OVERview:EPSK?	<Result>	query only	6.36
SAMPle[:SCALar]:MODulation:OVERview:EPSK?	<Result>	query only	6.36
INITiate:MODulation:PERRor:EPSK	–	no query	6.45
ABORt:MODulation:PERRor:EPSK	–	no query	6.45
STOP:MODulation:PERRor:EPSK	–	no query	6.45
CONTinue:MODulation:PERRor:EPSK	–	no query	6.45
CONFigure:SUBarrays:MODulation:PERRor:EPSK	ALL | ARIThmetical | MINimum | MAXimum,<Start>,<Samples>{,<Start>,<Samples>}	with query	6.48
READ:ARRAy:MODulation:PERRor:EPSK:AVERage?	–100.0 dB to +100.0 dB	query only	6.50
FETCh:ARRAy:MODulation:PERRor:EPSK:AVERage?	–100.0 dB to +100.0 dB	query only	6.50
SAMPle:ARRAy:MODulation:PERRor:EPSK:AVERage?	–100.0 dB to +100.0 dB	query only	6.50
READ:SUBarrays:MODulation:PERRor:EPSK:AVERage?	–100.0 dB to +20.0 dB	query only	6.51

Command	Parameter	Remark	Page
FETCh:SUBarrays:MODulation:PERRor:EPSK:AVERage?	–100.0 dB to +20.0 dB	query only	6.51
SAMPle:SUBarrays:MODulation:PERRor:EPSK:AVERage?	–100.0 dB to +20.0 dB	query only	6.51
CONFigure:MODulation:PERRor:EPSK:CONTrol	SCALar | ARRay, 1 to 1000 | NONE, CONTinuous | SINGleshot | 1 to 10000, SOERror | NONE,STEP | NONE	with query	6.46
DEFault:MODulation:PERRor:EPSK:CONTrol	ON | OFF	with query	6.48
CONFigure:MODulation:PERRor:EPSK:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SOERror | NONE, STEP | NONE	with query	6.47
CONFigure:MODulation:PERRor:EPSK:CONTrol:RMODe	SCALar | ARRay	with query	6.47
CONFigure:MODulation:PERRor:EPSK:CONTrol:STATistics	1 to 1000 | NONE	with query	6.47
READ:ARRAy:MODulation:PERRor:EPSK:CURRent?	–100.0 dB to +100.0 dB	query only	6.50
FETCh:ARRAy:MODulation:PERRor:EPSK:CURRent?	–100.0 dB to +100.0 dB	query only	6.50
SAMPle:ARRAy:MODulation:PERRor:EPSK:CURRent?	–100.0 dB to +100.0 dB	query only	6.50
READ:SUBarrays:MODulation:PERRor:EPSK:CURRent?	–100.0 dB to +20.0 dB	query only	6.51
FETCh:SUBarrays:MODulation:PERRor:EPSK:CURRent?	–100.0 dB to +20.0 dB	query only	6.51
SAMPle:SUBarrays:MODulation:PERRor:EPSK:CURRent?	–100.0 dB to +20.0 dB	query only	6.51
CONFigure:MODulation:PERRor:EPSK:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.45
CALCulate[:SCALar]:MODulation:PERRor:EPSK:MATChing:LIMit?	<Result>	query only	6.49
READ:ARRAy:MODulation:PERRor:EPSK:MMAXimum?	–100.0 dB to +100.0 dB	query only	6.50
FETCh:ARRAy:MODulation:PERRor:EPSK:MMAXimum?	–100.0 dB to +100.0 dB	query only	6.50
SAMPle:ARRAy:MODulation:PERRor:EPSK:MMAXimum?	–100.0 dB to +100.0 dB	query only	6.50
READ:SUBarrays:MODulation:PERRor:EPSK:MMAXimum?	–100.0 dB to +20.0 dB	query only	6.51
FETCh:SUBarrays:MODulation:PERRor:EPSK:MMAXimum?	–100.0 dB to +20.0 dB	query only	6.51
SAMPle:SUBarrays:MODulation:PERRor:EPSK:MMAXimum?	–100.0 dB to +20.0 dB	query only	6.51
FETCh:MODulation:PERRor:EPSK:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE , 1 to 1000 | NONE	query only	6.46
READ[:SCALar]:MODulation:PERRor:EPSK?	<Result>	query only	6.49
FETCh[:SCALar]:MODulation:PERRor:EPSK?	<Result>	query only	6.49
SAMPle[:SCALar]:MODulation:PERRor:EPSK?	<Result>	query only	6.49

Command	Parameter	Remark	Page
INITiate:MODulation:PERRor:GMSK	–	no query	6.24
ABORt:MODulation:PERRor:GMSK	–	no query	6.24
STOP:MODulation:PERRor:GMSK	–	no query	6.24
CONTinue:MODulation:PERRor:GMSK	–	no query	6.24
CONFigure:SUBarrays:MODulation:PERRor:GMSK	ALL | ARIThmetical | MINimum | MAXimum,<Start>,<Samples>{,<Start>,<Samples>}	with query	6.28
CONFigure:MODulation:PERRor:GMSK:AVERage:LIMit:[:SCALar]:SYMMetric[:COMBined]:VALue	0.0 deg to 50.0 deg, 0.0 deg to 50.0 deg, 0 Hz to 1000 Hz	with query	6.27
READ:ARRAy:MODulation:PERRor:GMSK:AVERage?	–100.0 dB to +100.0 dB	query only	6.30
FETCh:ARRAy:MODulation:PERRor:GMSK:AVERage?	–100.0 dB to +100.0 dB	query only	6.30
SAMPle:ARRAy:MODulation:PERRor:GMSK:AVERage?	–100.0 dB to +100.0 dB	query only	6.30
READ:SUBarrays:MODulation:PERRor:GMSK:AVERage?	–100.0 dB to +20.0 dB	query only	6.31
FETCh:SUBarrays:MODulation:PERRor:GMSK:AVERage?	–100.0 dB to +20.0 dB	query only	6.31
SAMPle:SUBarrays:MODulation:PERRor:GMSK:AVERage?	–100.0 dB to +20.0 dB	query only	6.31
CONFigure:MODulation:PERRor:GMSK:CMMax:LIMit:[:SCALar]:SYMMetric[:COMBined]:VALue	0.0 deg to 50.0 deg, 0.0 deg to 50.0 deg, 0 Hz to 1000 Hz	with query	6.26
CONFigure:MODulation:PERRor:GMSK:CONTrol	SCALar | ARRay, 1 to 1000 | NONE, CONTinuous | SINGleshot | 1 to 10000, SOERror | NONE,STEP | NONE	with query	6.25
DEFault:MODulation:PERRor:GMSK:CONTrol	ON | OFF	with query	6.26
CONFigure:MODulation:PERRor:GMSK:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SOERror | NONE, STEP | NONE	with query	6.26
CONFigure:MODulation:PERRor:GMSK:CONTrol:RMODe	SCALar | ARRay	with query	6.25
CONFigure:MODulation:PERRor:GMSK:CONTrol:STATistics	1 to 1000 | NONE	with query	6.25
READ:ARRAy:MODulation:PERRor:GMSK:CURRent?	–100.0 dB to +100.0 dB	query only	6.30
FETCh:ARRAy:MODulation:PERRor:GMSK:CURRent?	–100.0 dB to +100.0 dB	query only	6.30
SAMPle:ARRAy:MODulation:PERRor:GMSK:CURRent?	–100.0 dB to +100.0 dB	query only	6.30
READ:SUBarrays:MODulation:PERRor:GMSK:CURRent?	–100.0 dB to +20.0 dB	query only	6.31
FETCh:SUBarrays:MODulation:PERRor:GMSK:CURRent?	–100.0 dB to +20.0 dB	query only	6.31
SAMPle:SUBarrays:MODulation:PERRor:GMSK:CURRent?	–100.0 dB to +20.0 dB	query only	6.31
CONFigure:MODulation:PERRor:GMSK:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.24

Command	Parameter	Remark	Page
DEFault:MODulation:PERRor:GMSK:LIMit	ON | OFF	with query	6.27
CALCulate[:SCALar]:MODulation:PERRor:GMSK:MATChing:LIMit?	<Result>	query only	6.29
READ:ARRAy:MODulation:PERRor:GMSK:MMAXimum?	–100.0 dB to +100.0 dB	query only	6.30
FETCh:ARRAy:MODulation:PERRor:GMSK:MMAXimum?	–100.0 dB to +100.0 dB	query only	6.30
SAMPle:ARRAy:MODulation:PERRor:GMSK:MMAXimum?	–100.0 dB to +100.0 dB	query only	6.30
READ:SUBarrays:MODulation:PERRor:GMSK:MMAXimum?	–100.0 dB to +20.0 dB	query only	6.31
FETCh:SUBarrays:MODulation:PERRor:GMSK:MMAXimum?	–100.0 dB to +20.0 dB	query only	6.31
SAMPle:SUBarrays:MODulation:PERRor:GMSK:MMAXimum?	–100.0 dB to +20.0 dB	query only	6.31
FETCh:MODulation:PERRor:GMSK:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE , 1 to 1000 | NONE	query only	6.24
CONFigure:MODulation:PERRor:GMSK:TIME:DECode	STANdard | GTBits	with query	6.27
READ[:SCALar]:MODulation:PERRor:GMSK?	<Result>	query only	6.28
FETCh[:SCALar]:MODulation:PERRor:GMSK?	<Result>	query only	6.28
SAMPle[:SCALar]:MODulation:PERRor:GMSK?	<Result>	query only	6.28
Power measurement			
INITiate:POWer:NBURst:EPSK	–	no query	6.12
ABORt:POWer:NBURst:EPSK	–	no query	6.12
STOP:POWer:NBURst:EPSK	–	no query	6.12
CONTinue:POWer:NBURst:EPSK	–	no query	6.12
CONFigure:SUBarrays:POWer:NBURst:EPSK	ALL | ARITHmetical | MINimum | MAXimum,<Start>,<Samples>{,<Start>,<Samples>}	with query	6.19
CALCulate:ARRay:POWer:NBURst:EPSK:AVERage:MATChing:AREA?	<Matching>	query only	6.23
CALCulate:ARRay:POWer:NBURst:EPSK:AVERage:MATChing:LIMit?	<Matching>	query only	6.23
READ:ARRAy:POWer:NBURst:EPSK:AVERage?	–100.0 dB to +20.0 dB	query only	6.21
FETCh:ARRAy:POWer:NBURst:EPSK:AVERage?	–100.0 dB to +20.0 dB	query only	6.21
SAMPle:ARRAy:POWer:NBURst:EPSK:AVERage?	–100.0 dB to +20.0 dB	query only	6.21
READ:SUBarrays:POWer:NBURst:EPSK:AVERage?	–100.0 dB to +20.0 dB	query only	6.22

Command	Parameter	Remark	Page
FETCh:SUBarrays:POWer:NBURst:EPSK:AVERage?	–100.0 dB to +20.0 dB	query only	6.22
SAMPle:SUBarrays:POWer:NBURst:EPSK:AVERage?	–100.0 dB to +20.0 dB	query only	6.22
CONFigure:POWer:NBURst:EPSK:CONTrol	SCALar | ARRay, 1 to 1000 | NONE, CONTinuous | SINGleshot | 1 to 10000, SOERror | NONE,STEP | NONE	with query	6.13
DEFault:POWer:NBURst:EPSK:CONTrol	ON | OFF	with query	6.15
CONFigure:POWer:NBURst:EPSK:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SOERror | NONE,STEP | NONE	with query	6.14
CONFigure:POWer:NBURst:EPSK:CONTrol:RMODe	SCALar | ARRay	with query	6.14
CONFigure:POWer:NBURst:EPSK:CONTrol:STATistics	1 to 1000 | NONE	with query	6.14
CALCulate:ARRay:POWer:NBURst:EPSK:CURRent:MATChing:AREA?	<Matching>	query only	6.23
CALCulate:ARRay:POWer:NBURst:EPSK:CURRent:MATChing:LIMit?	<Matching>	query only	6.23
READ:ARRAy:POWer:NBURst:EPSK:CURRent?	–100.0 dB to +20.0 dB	query only	6.21
FETCh:ARRAy:POWer:NBURst:EPSK:CURRent?	–100.0 dB to +20.0 dB	query only	6.21
SAMPle:ARRAy:POWer:NBURst:EPSK:CURRent?	–100.0 dB to +20.0 dB	query only	6.21
READ:SUBarrays:POWer:NBURst:EPSK:CURRent?	–100.0 dB to +20.0 dB	query only	6.22
FETCh:SUBarrays:POWer:NBURst:EPSK:CURRent?	–100.0 dB to +20.0 dB	query only	6.22
SAMPle:SUBarrays:POWer:NBURst:EPSK:CURRent?	–100.0 dB to +20.0 dB	query only	6.22
CONFigure:POWer:NBURst:EPSK:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.12
DEFault:POWer:NBURst:EPSK:LIMit:LINE	ON | OFF	with query	6.18
CONFigure:POWer:NBURst:EPSK:LIMit:LINE:ASYMmetric:LOWer:AREA<nr>	<StartTime>, <EndTime>, <StartRelLevel>, <EndRelLevel>, <StartAbsLevel>, <EndAbsLevel>, <Visibility>	with query	6.17
CONFigure:POWer:NBURst:EPSK:LIMit:LINE:ASYMmetric:LOWer:AREA<nr>:VALue	<StartTime>, <EndTime>, <StartRelLevel>, <EndRelLevel>, <StartAbsLevel>, <EndAbsLevel>	with query	6.17
CONFigure:POWer:NBURst:EPSK:LIMit:LINE:ASYMmetric:LOWer:AREA<nr>:VALue:ENABle	ON | OFF	with query	6.17
CONFigure:POWer:NBURst:EPSK:LIMit:LINE:ASYMmetric:LOWer:ENABle	ON | OFF	with query	6.18
CONFigure:POWer:NBURst:EPSK:LIMit:LINE:ASYMmetric:UPPer:AREA<nr>	<StartTime>, <EndTime>, <StartRelLevel>, <EndRelLevel>, <StartAbsLevel>, <EndAbsLevel>, <Visibility>	with query	6.15

Command	Parameter	Remark	Page
CONFigure:POWer:NBURst:EPSK:LIMit:LINE:ASYMmetric:UPPer:AREA<nr>:VALue	<StartTime>, <EndTime>, <StartRelLevel>, <EndRelLevel>, <StartAbsLevel>, <EndAbsLevel>	with query	6.15
CONFigure:POWer:NBURst:EPSK:LIMit:LINE:ASYMmetric:UPPer:AREA<nr>:VALue:ENABle	ON | OFF	with query	6.15
CONFigure:POWer:NBURst:EPSK:LIMit:LINE:ASYMmetric:UPPer:ENABle	ON | OFF	with query	6.18
CALCulate[:SCALar]:POWer:NBURst:EPSK:MATChing:LIMit?	<Result>	query only	6.20
CALCulate:ARRay:POWer:NBURst:EPSK:MAXimum:MATChing:AREA?	<Matching>	query only	6.23
CALCulate:ARRay:POWer:NBURst:EPSK:MAXimum:MATChing:LIMit?	<Matching>	query only	6.23
READ:ARRAy:POWer:NBURst:EPSK:MAXimum?	–100.0 dB to +20.0 dB	query only	6.21
FETCh:ARRAy:POWer:NBURst:EPSK:MAXimum?	–100.0 dB to +20.0 dB	query only	6.21
SAMPle:ARRAy:POWer:NBURst:EPSK:MAXimum?	–100.0 dB to +20.0 dB	query only	6.21
READ:SUBarrays:POWer:NBURst:EPSK:MAXimum?	–100.0 dB to +20.0 dB	query only	6.22
FETCh:SUBarrays:POWer:NBURst:EPSK:MAXimum?	–100.0 dB to +20.0 dB	query only	6.22
SAMPle:SUBarrays:POWer:NBURst:EPSK:MAXimum?	–100.0 dB dB to +20.0 dB	query only	6.22
CALCulate:ARRay:POWer:NBURst:EPSK:MINimum:MATChing:AREA?	<Matching>	query only	6.23
CALCulate:ARRay:POWer:NBURst:EPSK:MINimum:MATChing:LIMit?	<Matching>	query only	6.23
READ:ARRAy:POWer:NBURst:EPSK:MINimum?	–100.0 dB to +20.0 dB	query only	6.21
FETCh:ARRAy:POWer:NBURst:EPSK:MINimum?	–100.0 dB to +20.0 dB	query only	6.21
SAMPle:ARRAy:POWer:NBURst:EPSK:MINimum?	–100.0 dB to +20.0 dB	query only	6.21
READ:SUBarrays:POWer:NBURst:EPSK:MINimum?	–100.0 dB to +20.0 dB	query only	6.22
FETCh:SUBarrays:POWer:NBURst:EPSK:MINimum?	–100.0 dB to +20.0 dB	query only	6.22
SAMPle:SUBarrays:POWer:NBURst:EPSK:MINimum?	–100.0 dB to +20.0 dB	query only	6.22
CONFigure:POWer:NBURst:EPSK:RPMode	CURRent | AVERage | DCOMpensated	with query	6.19
FETCh:POWer:NBURst:EPSK:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE , 1 to 1000 | NONE	query only	6.13
CONFigure:POWer:NBURst:EPSK:TIME:BOFFset	–4.00 to +4.00	with query	6.18
READ[:SCALar]:POWer:NBURst:EPSK?	<Result>	query only	6.20

Command	Parameter	Remark	Page
FETCh[:SCALar]:POWer:NBURst:EPSK?	<Result>	query only	6.20
SAMPle[:SCALar]:POWer:NBURst:EPSK?	<Result>	query only	6.20
INITiate:POWer:NBURst:GMSK	–	no query	6.12
ABORt:POWer:NBURst:GMSK	–	no query	6.12
STOP:POWer:NBURst:GMSK	–	no query	6.12
CONTinue:POWer:NBURst:GMSK	–	no query	6.12
CONFigure:SUBarrays:POWer:NBURst:GMSK	ALL | ARITHmetical | MINimum | MAXimum,<Start>,<Samples>{,<Start>,<Samples>}	with query	6.19
CALCulate:ARRay:POWer:NBURst:GMSK:AVERage:MATChing:AREA?	<Matching>	query only	6.23
CALCulate:ARRay:POWer:NBURst:GMSK:AVERage:MATChing:LIMit?	<Matching>	query only	6.23
READ:ARRAy:POWer:NBURst:GMSK:AVERage?	–100.0 dB to +20.0 dB	query only	6.21
FETCh:ARRAy:POWer:NBURst:GMSK:AVERage?	–100.0 dB to +20.0 dB	query only	6.21
SAMPle:ARRAy:POWer:NBURst:GMSK:AVERage?	–100.0 dB to +20.0 dB	query only	6.21
READ:SUBarrays:POWer:NBURst:GMSK:AVERage?	–100.0 dB to +20.0 dB	query only	6.22
FETCh:SUBarrays:POWer:NBURst:GMSK:AVERage?	–100.0 dB to +20.0 dB	query only	6.22
SAMPle:SUBarrays:POWer:NBURst:GMSK:AVERage?	–100.0 dB to +20.0 dB	query only	6.22
CONFigure:POWer:NBURst:GMSK:CONTrol	SCALar | ARRay, 1 to 1000 | NONE, CONTinuous | SINGleshot | 1 to 10000, SOERror | NONE,STEP | NONE	with query	6.13
DEFault:POWer:NBURst:GMSK:CONTrol	ON | OFF	with query	6.15
CONFigure:POWer:NBURst:GMSK:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SOERror | NONE,STEP | NONE	with query	6.14
CONFigure:POWer:NBURst:GMSK:CONTrol:RMODe	SCALar | ARRay	with query	6.14
CONFigure:POWer:NBURst:GMSK:CONTrol:STATistics	1 to 1000 | NONE	with query	6.14
CALCulate:ARRay:POWer:NBURst:GMSK:CURRent:MATChing:AREA?	<Matching>	query only	6.23
CALCulate:ARRay:POWer:NBURst:GMSK:CURRent:MATChing:LIMit?	<Matching>	query only	6.23
READ:ARRAy:POWer:NBURst:GMSK:CURRent?	–100.0 dB to +20.0 dB	query only	6.21
FETCh:ARRAy:POWer:NBURst:GMSK:CURRent?	–100.0 dB to +20.0 dB	query only	6.21

Command	Parameter	Remark	Page
SAMPle:ARRAy:POWer:NBURst:GMSK:CURRent?	–100.0 dB to +20.0 dB	query only	6.21
READ:SUBarrays:POWer:NBURst:GMSK:CURRent?	–100.0 dB to +20.0 dB	query only	6.22
FETCh:SUBarrays:POWer:NBURst:GMSK:CURRent?	–100.0 dB to +20.0 dB	query only	6.22
SAMPle:SUBarrays:POWer:NBURst:GMSK:CURRent?	–100.0 dB to +20.0 dB	query only	6.22
CONFigure:POWer:NBURst:GMSK:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.12
DEFault:POWer:NBURst:GMSK:LIMit:LINE	ON | OFF	with query	6.18
CONFigure:POWer:NBURst:GMSK:LIMit:LINE:ASYMmetric:LOWer:AREA<nr>	<StartTime>, <EndTime>, <StartRelLevel>, <EndRelLevel>, <StartAbsLevel>, <EndAbsLevel>, <Visibility>	with query	6.17
CONFigure:POWer:NBURst:GMSK:LIMit:LINE:ASYMmetric:LOWer:AREA<nr>:VALue	<StartTime>, <EndTime>, <StartRelLevel>, <EndRelLevel>, <StartAbsLevel>, <EndAbsLevel>	with query	6.17
CONFigure:POWer:NBURst:GMSK:LIMit:LINE:ASYMmetric:LOWer:AREA<nr>:VALue:ENABle	ON | OFF	with query	6.17
CONFigure:POWer:NBURst:GMSK:LIMit:LINE:ASYMmetric:LOWer:ENABle	ON | OFF	with query	6.18
CONFigure:POWer:NBURst:GMSK:LIMit:LINE:ASYMmetric:UPPer:AREA<nr>	<StartTime>, <EndTime>, <StartRelLevel>, <EndRelLevel>, <StartAbsLevel>, <EndAbsLevel>, <Visibility>	with query	6.15
CONFigure:POWer:NBURst:GMSK:LIMit:LINE:ASYMmetric:UPPer:AREA<nr>:VALue	<StartTime>, <EndTime>, <StartRelLevel>, <EndRelLevel>, <StartAbsLevel>, <EndAbsLevel>	with query	6.15
CONFigure:POWer:NBURst:GMSK:LIMit:LINE:ASYMmetric:UPPer:AREA<nr>:VALue:ENABle	ON | OFF	with query	6.15
CONFigure:POWer:NBURst:GMSK:LIMit:LINE:ASYMmetric:UPPer:ENABle	ON | OFF	with query	6.18
CALCulate[:SCALar]:POWer:NBURst:GMSK:MATChing:LIMit?	<Result>	query only	6.20
CALCulate:ARRay:POWer:NBURst:GMSK:MAXimum:MATChing:AREA?	<Matching>	query only	6.23
CALCulate:ARRay:POWer:NBURst:GMSK:MAXimum:MATChing:LIMit?	<Matching>	query only	6.23
READ:ARRAy:POWer:NBURst:GMSK:MAXimum?	–100.0 dB to +20.0 dB	query only	6.21
FETCh:ARRAy:POWer:NBURst:GMSK:MAXimum?	–100.0 dB to +20.0 dB	query only	6.21
SAMPle:ARRAy:POWer:NBURst:GMSK:MAXimum?	–100.0 dB to +20.0 dB	query only	6.21
READ:SUBarrays:POWer:NBURst:GMSK:MAXimum?	–100.0 dB to +20.0 dB	query only	6.22
FETCh:SUBarrays:POWer:NBURst:GMSK:MAXimum?	–100.0 dB to +20.0 dB	query only	6.22

Command	Parameter	Remark	Page
SAMPle:SUBarrays:POWer:NBURst:GMSK:MAXimum?	–100.0 dB dB to +20.0 dB	query only	6.22
CALCulate:ARRay:POWer:NBURst:GMSK:MINimum:MATChing:AREA?	<Matching>	query only	6.23
CALCulate:ARRay:POWer:NBURst:GMSK:MINimum:MATChing:LIMit?	<Matching>	query only	6.23
READ:ARRAy:POWer:NBURst:GMSK:MINimum?	–100.0 dB to +20.0 dB	query only	6.21
FETCh:ARRAy:POWer:NBURst:GMSK:MINimum?	–100.0 dB to +20.0 dB	query only	6.21
SAMPle:ARRAy:POWer:NBURst:GMSK:MINimum?	–100.0 dB to +20.0 dB	query only	6.21
READ:SUBarrays:POWer:NBURst:GMSK:MINimum?	–100.0 dB to +20.0 dB	query only	6.22
FETCh:SUBarrays:POWer:NBURst:GMSK:MINimum?	–100.0 dB to +20.0 dB	query only	6.22
SAMPle:SUBarrays:POWer:NBURst:GMSK:MINimum?	–100.0 dB to +20.0 dB	query only	6.22
FETCh:POWer:NBURst:GMSK:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE , 1 to 1000 | NONE	query only	6.13
CONFigure:POWer:NBURst:GMSK:TIME:BOFFset	–4.00 to +4.00	with query	6.18
READ[:SCALar]:POWer:NBURst:GMSK?	<Result>	query only	6.20
FETCh[:SCALar]:POWer:NBURst:GMSK?	<Result>	query only	6.20
SAMPle[:SCALar]:POWer:NBURst:GMSK?	<Result>	query only	6.20
RF Analyzer			
[SENSe:]RFANalyzer:FOFFset	<FreqOffset>	with query	6.4
[SENSe:]RFANalyzer:FREQuency	<Frequency>	with query	6.4
[SENSe:]RFANalyzer:FREQuency:UNIT	Hz | KHZ | MHZ | GHZ | CH	with query	6.4
[SENSe:]RFANalyzer:TSEQuence	OFF | GSM0 to GSM7 | DUMMy | ANY	with query	6.5
RF Generator			
INITiate:RFGenerator	–	no query	6.5
ABORt:RFGenerator	–	no query	6.5
SOURce:RFGenerator:FOFFset	<FrequencyOffset>	with query	6.7
SOURce:RFGenerator:FREQuency	<Frequency>	with query	6.6
SOURce:RFGenerator:FREQuency:UNIT	Hz | KHZ | MHZ | GHZ | CH	with query	6.6
SOURce:RFGenerator:LEVel:UNTimeslot	<Level>	with query	6.6

Command	Parameter	Remark	Page
SOURce:RFGenerator:LEVel:UTIMeslot	<Level>	with query	6.5
CONFigure:RFGenerator:MODulation:BMODulation	<Selection>	with query	6.7
CONFigure:RFGenerator:MODulation:TRANsmission	<TRANsmission>	with query	6.7
CONFigure:RFGenerator:MODulation:TSEQuence	<Selection>	with query	6.7
FETCh:RFGenerator:STATus?	OFF | RUN | STOP | ERR	query only	6.5
Spectrum due to modulation measurements			
CONFigure:SPECtrum[:COMMon]:NOISe:CORRection	ON | OFF	with query	6.58
INITiate:SPECtrum:MODulation:EPSK	–	no query	6.58
ABORt:SPECtrum:MODulation:EPSK	–	no query	6.58
STOP:SPECtrum:MODulation:EPSK	–	no query	6.58
CONTinue:SPECtrum:MODulation:EPSK	–	no query	6.58
CONFigure:SUBarrays:SPECtrum:MODulation:EPSK	ALL | ARIThmetical | MINimum | MAXimum,<Start>,<Samples>{,<Start>,<Samples>}	with query	6.64
CONFigure:SPECtrum:MODulation:EPSK:CONTrol	SCALar | ARRay, 1 to 1000 | NONE, CONTinuous | SINGleshot | 1 to 10000, SOERror | NONE,STEP | NONE	with query	6.59
DEFault:SPECtrum:MODulation:EPSK:CONTrol	ON | OFF	with query	6.61
CONFigure:SPECtrum:MODulation:EPSK:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SOERror | NONE, STEP | NONE	with query	6.61
CONFigure:SPECtrum:MODulation:EPSK:CONTrol:RMODe	SCALar | ARRay	with query	6.60
CONFigure:SPECtrum:MODulation:EPSK:CONTrol:STATistics	1 to 1000 | NONE	with query	6.60
CONFigure:SPECtrum:MODulation:EPSK:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.59
DEFault:SPECtrum:MODulation:EPSK:LIMit:LINE	ON | OFF	with query	6.63
CONFigure:SPECtrum:MODulation:EPSK:LIMit:LINE:SYMMetric[:COMBined]:ENABle	ON | OFF	with query	6.63
CONFigure:SPECtrum:MODulation:EPSK:LIMit:LINE:SYMMetric[:COMBined]:FREQuency<nr>	<MinLevel>,<MaxLevel>,<AbsLevel>,<Enable>	with query	6.62
CONFigure:SPECtrum:MODulation:EPSK:LIMit:LINE:SYMMetric[:COMBined]:FREQuency<nr>:ENABle	ON | OFF	with query	6.62
CONFigure:SPECtrum:MODulation:EPSK:LIMit:LINE:SYMMetric[:COMBined]:FREQuency<nr>:VALue	<MinLevel>,<MaxLevel>,<AbsLevel>	with query	6.62

Command	Parameter	Remark	Page
CONFigure:SPECtrum:MODulation:EPSK:LIMit:LINE:SYMMetric[:COMBined]:RPOWer	<Minimum>, <Maximum>	with query	6.63
CONFigure:SPECtrum:MODulation:EPSK:MPOint<nr>:ENABle	ON | OFF	with query	6.64
FETCh:SPECtrum:MODulation:EPSK:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE , 1 to 1000 | NONE	only query	6.59
FETCh[:SCALar]:SPECtrum:MODulation:EPSK?	<Result>	only query	6.65
SAMPle[:SCALar]:SPECtrum:MODulation:EPSK?	<Result>	only query	6.65
READ:ARRAy:SPECtrum:MODulation:EPSK?	–100.0 dB to +20.0 dB	only query	6.66
FETCh:ARRAy:SPECtrum:MODulation:EPSK?	–100.0 dB to +20.0 dB	only query	6.66
SAMPle:ARRAy:SPECtrum:MODulation:EPSK?	–100.0 dB to +20.0 dB	only query	6.66
READ:SUBarrays:SPECtrum:MODulation:EPSK?	–100.0 dB to +20.0 dB, ...	query only	6.66
FETCh:SUBarrays:SPECtrum:MODulation:EPSK?	–100.0 dB to +20.0 dB, ...	query only	6.66
FETCh:SUBarrays:SPECtrum:MODulation:EPSK?	–100.0 dB to +20.0 dB, ...	query only	6.66
SAMPle:SUBarrays:SPECtrum:MODulation:EPSK?	–100.0 dB to +20.0 dB, ...	query only	6.66
INITiate:SPECtrum:MODulation:GMSK	–	no query	6.58
ABORt:SPECtrum:MODulation:GMSK	–	no query	6.58
STOP:SPECtrum:MODulation:GMSK	–	no query	6.58
CONTinue:SPECtrum:MODulation:GMSK	–	no query	6.58
CONFigure:SUBarrays:SPECtrum:MODulation:GMSK	ALL | ARIThmetical | MINimum | MAXimum,<Start>,<Samples>{,<Start>,<Samples>}	with query	6.64
CONFigure:SPECtrum:MODulation:GMSK:CONTrol	SCALar | ARRay, 1 to 1000 | NONE, CONTinuous | SINGleshot | 1 to 10000, SOERror | NONE,STEP | NONE	with query	6.59
DEFault:SPECtrum:MODulation:GMSK:CONTrol	ON | OFF	with query	6.61
CONFigure:SPECtrum:MODulation:GMSK:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SOERror | NONE, STEP | NONE	with query	6.61
CONFigure:SPECtrum:MODulation:GMSK:CONTrol:RMODe	SCALar | ARRay	with query	6.60
CONFigure:SPECtrum:MODulation:GMSK:CONTrol:STATistics	1 to 1000 | NONE	with query	6.60
CONFigure:SPECtrum:MODulation:GMSK:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.59
DEFault:SPECtrum:MODulation:GMSK:LIMit:LINE	ON | OFF	with query	6.63

Command	Parameter	Remark	Page
CONFigure:SPECtrum:MODulation:GMSK:LIMit:LINE:SYMMetric[:COMBined]:ENABle	ON | OFF	with query	6.63
CONFigure:SPECtrum:MODulation:GMSK:LIMit:LINE:SYMMetric[:COMBined]:FREQuency<nr>	<MinLevel>,<MaxLevel>,<AbsLevel>,<Enable>	with query	6.62
CONFigure:SPECtrum:MODulation:GMSK:LIMit:LINE:SYMMetric[:COMBined]:FREQuency<nr>:ENABle	ON | OFF	with query	6.62
CONFigure:SPECtrum:MODulation:GMSK:LIMit:LINE:SYMMetric[:COMBined]:FREQuency<nr>:VALue	<MinLevel>,<MaxLevel>,<AbsLevel>	with query	6.62
CONFigure:SPECtrum:MODulation:GMSK:LIMit:LINE:SYMMetric[:COMBined]:RPOWer	<Minimum>, <Maximum>	with query	6.63
CONFigure:SPECtrum:MODulation:GMSK:MPOint<nr>:ENABle	ON | OFF	with query	6.64
FETCh:SPECtrum:MODulation:GMSK:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE , 1 to 1000 | NONE	only query	6.59
FETCh[:SCALar]:SPECtrum:MODulation:GMSK?	<Result>	only query	6.65
SAMPle[:SCALar]:SPECtrum:MODulation:GMSK?	<Result>	only query	6.65
READ:ARRAy:SPECtrum:MODulation:GMSK?	–100.0 dB to +20.0 dB	only query	6.66
FETCh:ARRAy:SPECtrum:MODulation:GMSK?	–100.0 dB to +20.0 dB	only query	6.66
SAMPle:ARRAy:SPECtrum:MODulation:GMSK?	–100.0 dB to +20.0 dB	only query	6.66
READ:SUBarrays:SPECtrum:MODulation:GMSK?	–100.0 dB to +20.0 dB, ...	query only	6.66
FETCh:SUBarrays:SPECtrum:MODulation:GMSK?	–100.0 dB to +20.0 dB, ...	query only	6.66
FETCh:SUBarrays:SPECtrum:MODulation:GMSK?	–100.0 dB to +20.0 dB, ...	query only	6.66
SAMPle:SUBarrays:SPECtrum:MODulation:GMSK?	–100.0 dB to +20.0 dB, ...	query only	6.66
READ[:SCALar]:SPECtrum:MOdulation?	<Result>	only query	6.65
READ[:SCALar]:SPECtrum:MOdulation?	<Result>	only query	6.65
Spectrum due to switching measurements			
INITiate:SPECtrum:SWITching:EPSK	–	no query	6.67
ABORt:SPECtrum:SWITching:EPSK	–	no query	6.67
STOP:SPECtrum:SWITching:EPSK	–	no query	6.67
CONTinue:SPECtrum:SWITching:EPSK	–	no query	6.67
CONFigure:SUBarrays:SPECtrum:SWITching:EPSK	ALL | ARIThmetical | MINimum | MAXimum,<Start>,<Samples>{,<Start>,<Samples>}	with query	6.72

Command	Parameter	Remark	Page
SAMPle[:SCALar]:SPECtrum:SWITching:EPSK ?	<Result>	only query	6.73
CONFigure:SPECtrum:SWITching:EPSK:CONTrol	SCALar | ARRay, 1 to 1000 | NONE, CONTinuous | SINGleshot | 1 to 10000, SOERror | NONE,STEP | NONE	with query	6.68
DEFault:SPECtrum:SWITching:EPSK:CONTrol	ON | OFF	with query	6.70
CONFigure:SPECtrum:SWITching:EPSK:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SOERror | NONE, STEP | NONE	with query	6.69
CONFigure:SPECtrum:SWITching:EPSK:CONTrol:RMODe	SCALar | ARRay	with query	6.69
CONFigure:SPECtrum:SWITching:EPSK:CONTrol:STATistics	1 to 1000 | NONE	with query	6.69
CONFigure:SPECtrum:SWITching:EPSK:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.67
DEFault:SPECtrum:SWITching:EPSK:LIMit:LINE	ON | OFF	with query	6.71
CONFigure:SPECtrum:SWITching:EPSK:LIMit:LINE:SYMMetric[:COMBined]:ENABle	ON | OFF	with query	6.71
CONFigure:SPECtrum:SWITching:EPSK:LIMit:LINE:SYMMetric[:COMBined]:FREQuency<nr>	<MinLevel>,<MaxLevel>,<AbsLevel>,<Enable>	with query	6.70
CONFigure:SPECtrum:SWITching:EPSK:LIMit:LINE:SYMMetric[:COMBined]:FREQuency<nr>:ENABle	ON | OFF	with query	6.70
CONFigure:SPECtrum:SWITching:EPSK:LIMit:LINE:SYMMetric[:COMBined]:FREQuency<nr>:VALue	<MinLevel>,<MaxLevel>,<AbsLevel>	with query	6.70
CONFigure:SPECtrum:SWITching:EPSK:MPOint<nr>:ENABle	ON | OFF	with query	6.72
FETCh:SPECtrum:SWITching:EPSK:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE , 1 to 1000 | NONE	only query	6.68
READ[:SCALar]:SPECtrum:SWITching:EPSK?	<Result>	only query	6.73
FETCh[:SCALar]:SPECtrum:SWITching:EPSK?	<Result>	only query	6.73
READ:ARRAy:SPECtrum:SWITching:EPSK?	–100.0 dB to +20.0 dB	only query	6.74
FETCh:ARRAy:SPECtrum:SWITching:EPSK?	–100.0 dB to +20.0 dB	only query	6.74
SAMPle:ARRAy:SPECtrum:SWITching:EPSK?	–100.0 dB to +20.0 dB	only query	6.74
READ:SUBarrays:SPECtrum:SWITching:EPSK?	–100.0 dB to +20.0 dB, ...	query only	6.74
FETCh:SUBarrays:SPECtrum:SWITching:EPSK?	–100.0 dB to +20.0 dB, ...	query only	6.74
FETCh:SUBarrays:SPECtrum:SWITching:EPSK?	–100.0 dB to +20.0 dB, ...	query only	6.74
SAMPle:SUBarrays:SPECtrum:SWITching:EPSK?	–100.0 dB to +20.0 dB, ...	query only	6.74

Command	Parameter	Remark	Page
INITiate:SPECtrum:SWITching:GMSK	–	no query	6.67
ABORt:SPECtrum:SWITching:GMSK	–	no query	6.67
STOP:SPECtrum:SWITching:GMSK	–	no query	6.67
CONTinue:SPECtrum:SWITching:GMSK	–	no query	6.67
CONFigure:SUBarrays:SPECtrum:SWITching:GMSK	ALL | ARIThmetical | MINimum | MAXimum,<Start>,<Samples>{,<Start>,<Samples>}	with query	6.72
SAMPle[:SCALar]:SPECtrum:SWITching:GMSK ?	<Result>	only query	6.73
CONFigure:SPECtrum:SWITching:GMSK:CONTrol	SCALar | ARRay, 1 to 1000 | NONE, CONTinuous | SINGleshot | 1 to 10000, SOERror | NONE,STEP | NONE	with query	6.68
DEFault:SPECtrum:SWITching:GMSK:CONTrol	ON | OFF	with query	6.70
CONFigure:SPECtrum:SWITching:GMSK:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SOERror | NONE, STEP | NONE	with query	6.69
CONFigure:SPECtrum:SWITching:GMSK:CONTrol:RMODe	SCALar | ARRay	with query	6.69
CONFigure:SPECtrum:SWITching:GMSK:CONTrol:STATistics	1 to 1000 | NONE	with query	6.69
CONFigure:SPECtrum:SWITching:GMSK:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.67
DEFault:SPECtrum:SWITching:GMSK:LIMit:LINE	ON | OFF	with query	6.71
CONFigure:SPECtrum:SWITching:GMSK:LIMit:LINE:SYMMetric[:COMBined]:ENABle	ON | OFF	with query	6.71
CONFigure:SPECtrum:SWITching:GMSK:LIMit:LINE:SYMMetric[:COMBined]:FREQuency<nr>	<MinLevel>,<MaxLevel>,<AbsLevel>,<Enable>	with query	6.70
CONFigure:SPECtrum:SWITching:GMSK:LIMit:LINE:SYMMetric[:COMBined]:FREQuency<nr>:ENABle	ON | OFF	with query	6.70
CONFigure:SPECtrum:SWITching:GMSK:LIMit:LINE:SYMMetric[:COMBined]:FREQuency<nr>:VALue	<MinLevel>,<MaxLevel>,<AbsLevel>	with query	6.70
CONFigure:SPECtrum:SWITching:GMSK:MPOint<nr>:ENABle	ON | OFF	with query	6.72
FETCh:SPECtrum:SWITching:GMSK:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE , 1 to 1000 | NONE	only query	6.68
READ[:SCALar]:SPECtrum:SWITching:GMSK?	<Result>	only query	6.73
FETCh[:SCALar]:SPECtrum:SWITching:GMSK?	<Result>	only query	6.73
READ:ARRAy:SPECtrum:SWITching:GMSK?	–100.0 dB to +20.0 dB	only query	6.74

Command	Parameter	Remark	Page
FETCh:ARRAy:SPECtrum:SWITching:GMSK?	–100.0 dB to +20.0 dB	only query	6.74
SAMPle:ARRAy:SPECtrum:SWITching:GMSK?	–100.0 dB to +20.0 dB	only query	6.74
READ:SUBarrays:SPECtrum:SWITching:GMSK?	–100.0 dB to +20.0 dB, ...	query only	6.74
FETCh:SUBarrays:SPECtrum:SWITching:GMSK?	–100.0 dB to +20.0 dB, ...	query only	6.74
FETCh:SUBarrays:SPECtrum:SWITching:GMSK?	–100.0 dB to +20.0 dB, ...	query only	6.74
SAMPle:SUBarrays:SPECtrum:SWITching:GMSK?	–100.0 dB to +20.0 dB, ...	query only	6.74
Trigger			
DEFault:TRIGger[:SEQuence]	ON | OFF	with query	6.3
TRIGger[:SEQuence]:SOURce	IMMediate | POWer | EXTern	with query	6.3
TRIGger[:SEQuence]:THReshold	LOW | MEDium | HIGH	with query	6.3
Measured wide band power			
INITiate:WPOWer	–	no query	6.10
ABORt:WPOWer	–	no query	6.10
STOP:WPOWer	–	no query	6.10
CONTinue:WPOWer	–	no query	6.10
CONFigure:WPOWer:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SOERror | NONE,STEP | NONE	with query	6.11
CONFigure:WPOWer:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.10
FETCh:WPOWer:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE	query only	6.10
READ[:SCALar]:WPOWer?	–	query only	6.11
FETCh[:SCALar]:WPOWer?	–	query only	6.11
SAMPle[:SCALar]:WPOWer?	–	query only	6.11

Commands for GSM Measurements with Signalling

Table 6-2 Remote-control commands: Signalling mode

Command	Parameter	Remark	Page
Signal from the base station under test			
DEFault:BSSignal	ON | OFF	with query	6.81
CONFigure:BSSignal:CCH:CHANnel	<ChannelNumber>	with query	6.79
CONFigure:BSSignal:TCH:CHANnel	<ChannelNumber>	with query	6.79
[SENSe:]BSSignal:TCH:CHANnel?	<ChannelNumber>	with query	6.80
CONFigure:BSSignal:TCH:CHTYpe	<Type>	with query	6.80
CONFigure:BSSignal:TCH:TIMeslot	0 to 7	with query	6.80
[SENSe:]BSSignal:TCH:TIMeslot?	0 to 7	with query	6.80
CONFigure:BSSignal:TCH:TSEQuence	GSM0 to GSM7	with query	6.80
Inputs and Outputs			
[SENSe]:CORRection:LOSS:INPut<nr>[:MAGNitude]	<Attenuation>	with query	6.89
SOURce:CORRection:LOSS:INPut<nr>[:MAGNitude]	<Attenuation>	with query	6.89
[SENSe:]CORRection:LOSS:OUTPut<nr>[:MAGNitude]	<Attenuation>	with query	6.89
SOURce:CORRection:LOSS:OUTPut<nr>[:MAGNitude]	<Attenuation>	with query	6.89
SOURce:DM:CLOCk:FREQuency	<Frequency>	with query	6.90
SOURce:DM:CLOCk:STATe	ON | OFF	with query	6.89
INPut[:STATe]	RF1 | RF2 | RF4	with query	6.88
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Expected power			
DEFault:EPOWer	ON | OFF	with query	6.76
[SENSe:]EPOWer:ATTenuation	NORMal | LNOise | LDIStortion	with query	6.75
[SENSe:]EPOWer:MODE	MANual | AUTO	with query	6.75
[SENSe:]EPOWer:VALue	<Level>	with query	6.75
External trigger			
CONFigure:EXTernal[:TRIGger][:INPut]:BITDelay	RISing | FALLing	with query	6.90

Command	Parameter	Remark	Page
CONFigure:EXTernal[:TRIGger][:INPut]:POLarity	RISing | FALLing	with query	6.90
CONFigure:EXTernal[:TRIGger][:INPut]:SOFFset	RISing | FALLing	with query	6.90
Signalling Info			
[SENSe:]INFO: NETWorkdata:LOCation:UPDate?	–	query only	6.43
[SENSe:]INFO:FRAMetiming:MULTiframe?	–	query only	6.42
[SENSe:]INFO:FRAMetiming:SUPerframe?	–	query only	6.43
[SENSe:]INFO:NETWorkdata:BSIC?	–	query only	6.43
[SENSe:]INFO:NETWorkdata:LOCation:AREA?	–	query only	6.43
[SENSe:]INFO:NETWorkdata:MCC?	–	query only	6.43
[SENSe:]INFO:NETWorkdata:MNC?	–	query only	6.43
[SENSe:]INFO:SACChinfo:REQuested:POWer?	–	query only	6.44
[SENSe:]INFO:SACChinfo:REQuested:TIMing?	–	query only	6.44
Modulation measurements			
INITiate:MODulation:EVMagnitude:EPSK:TCH	–	no query	6.126
ABORt:MODulation:EVMagnitude:EPSK:TCH	–	no query	6.126
STOP:MODulation:EVMagnitude:EPSK:TCH	–	no query	6.126
CONTinue:MODulation:EVMagnitude:EPSK:TCH	–	no query	6.126
CONFigure:SUBarrays:MODulation:EVMagnitude:EPSK:TCH	ALL | ARIThmetical | MINimum | MAXimum,<Start>,<Samples>{,<Start>,<Samples>}	with query	6.129
READ:ARRAy:MODulation:EVMagnitude:EPSK:TCH:AVERage?	–100.0 dB to +100.0 dB	query only	6.131
FETCh:ARRAy:MODulation:EVMagnitude:EPSK:TCH:AVERage?	–100.0 dB to +100.0 dB	query only	6.131
SAMPle:ARRAy:MODulation:EVMagnitude:EPSK:TCH:AVERage?	–100.0 dB to +100.0 dB	query only	6.131
READ:SUBarrays:MODulation:EVMagnitude:EPSK:TCH:AVERage?	–100.0 dB to +20.0 dB	query only	6.132
FETCh:SUBarrays:MODulation:EVMagnitude:EPSK:TCH:AVERage?	–100.0 dB to +20.0 dB	query only	6.132
SAMPle:SUBarrays:MODulation:EVMagnitude:EPSK:TCH:AVERage?	–100.0 dB to +20.0 dB	query only	6.132
CONFigure:MODulation:EVMagnitude:EPSK:TCH:CONTrol	SCALar | ARRay, 1 to 1000 | NONE, CONTinuous | SINGleshot | 1 to 10000, SOERror | NONE,STEP |	with query	6.127

Command	Parameter	Remark	Page
	NONE		
DEFault:MODulation:EVMagnitude:EPSK:TCH:CONTrol	ON | OFF	with query	6.129
CONFigure:MODulation:EVMagnitude:EPSK:TCH:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SOERror | NONE, STEP | NONE	with query	6.128
CONFigure:MODulation:EVMagnitude:EPSK:TCH:CONTrol:RMODe	SCALar | ARRay	with query	6.128
CONFigure:MODulation:EVMagnitude:EPSK:TCH:CONTrol:STATistics	1 to 1000 | NONE	with query	6.128
READ:ARRAy:MODulation:EVMagnitude:EPSK:TCH:CURRent?	–100.0 dB to +100.0 dB	query only	6.131
FETCh:ARRAy:MODulation:EVMagnitude:EPSK:TCH:CURRent?	–100.0 dB to +100.0 dB	query only	6.131
SAMPle:ARRAy:MODulation:EVMagnitude:EPSK:TCH:CURRent?	–100.0 dB to +100.0 dB	query only	6.131
READ:SUBarrays:MODulation:EVMagnitude:EPSK:TCH:CURRent?	–100.0 dB to +20.0 dB	query only	6.132
FETCh:SUBarrays:MODulation:EVMagnitude:EPSK:TCH:CURRent?	–100.0 dB to +20.0 dB	query only	6.132
SAMPle:SUBarrays:MODulation:EVMagnitude:EPSK:TCH:CURRent?	–100.0 dB to +20.0 dB	query only	6.132
CONFigure:MODulation:EVMagnitude:EPSK:TCH:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.126
CALCulate[:SCALar]:MODulation:EVMagnitude:EPSK:TCH:MATChing:LIMit?	<Result>	query only	6.130
READ:ARRAy:MODulation:EVMagnitude:EPSK:TCH:MMAXimum?	–100.0 dB to +100.0 dB	query only	6.131
FETCh:ARRAy:MODulation:EVMagnitude:EPSK:TCH:MMAXimum?	–100.0 dB to +100.0 dB	query only	6.131
SAMPle:ARRAy:MODulation:EVMagnitude:EPSK:TCH:MMAXimum?	–100.0 dB to +100.0 dB	query only	6.131
READ:SUBarrays:MODulation:EVMagnitude:EPSK:TCH:MMAXimum?	–100.0 dB to +20.0 dB	query only	6.132
FETCh:SUBarrays:MODulation:EVMagnitude:EPSK:TCH:MMAXimum?	–100.0 dB to +20.0 dB	query only	6.132
SAMPle:SUBarrays:MODulation:EVMagnitude:EPSK:TCH:MMAXimum?	–100.0 dB to +20.0 dB	query only	6.132
FETCh:MODulation:EVMagnitude:EPSK:TCH:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE , 1 to 1000 | NONE	query only	6.127
READ[:SCALar]:MODulation:EVMagnitude:EPSK:TCH?	<Result>	query only	6.130
FETCh[:SCALar]:MODulation:EVMagnitude:EPSK:TCH?	<Result>	query only	6.130
SAMPle[:SCALar]:MODulation:EVMagnitude:EPSK:TCH?	<Result>	query only	6.130

Command	Parameter	Remark	Page
INITiate:MODulation:MERRor:EPSK:TCH	–	no query	6.140
ABORt:MODulation:MERRor:EPSK:TCH	–	no query	6.140
STOP:MODulation:MERRor:EPSK:TCH	–	no query	6.140
CONTinue:MODulation:MERRor:EPSK:TCH	–	no query	6.140
CONFigure:SUBarrays:MODulation:MERRor:EPSK:TCH	ALL | ARIThmetical | MINimum | MAXimum,<Start>,<Samples> {,<Start>,<Samples>}	with query	6.143
READ:ARRAy:MODulation:MERRor:EPSK:TCH:AVERage?	–100.0 dB to +100.0 dB	query only	6.145
FETCh:ARRAy:MODulation:MERRor:EPSK:TCH:AVERage?	–100.0 dB to +100.0 dB	query only	6.145
SAMPle:ARRAy:MODulation:MERRor:EPSK:TCH:AVERage?	–100.0 dB to +100.0 dB	query only	6.145
READ:SUBarrays:MODulation:MERRor:EPSK:TCH:AVERage?	–100.0 dB to +20.0 dB	query only	6.146
FETCh:SUBarrays:MODulation:MERRor:EPSK:TCH:AVERage?	–100.0 dB to +20.0 dB	query only	6.146
SAMPle:SUBarrays:MODulation:MERRor:EPSK:TCH:AVERage?	–100.0 dB to +20.0 dB	query only	6.146
CONFigure:MODulation:MERRor:EPSK:TCH:CONTrol	SCALar | ARRay, 1 to 1000 | NONE, CONTinuous | SINGleshot | 1 to 10000, SOERror | NONE,STEP | NONE	with query	6.141
DEFault:MODulation:MERRor:EPSK:TCH:CONTrol	ON | OFF	with query	6.142
CONFigure:MODulation:MERRor:EPSK:TCH:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SOERror | NONE, STEP | NONE	with query	6.142
CONFigure:MODulation:MERRor:EPSK:TCH:CONTrol:RMODe	SCALar | ARRay	with query	6.142
CONFigure:MODulation:MERRor:EPSK:TCH:CONTrol:STATistics	1 to 1000 | NONE	with query	6.142
READ:ARRAy:MODulation:MERRor:EPSK:TCH:CURRent?	–100.0 dB to +100.0 dB	query only	6.145
FETCh:ARRAy:MODulation:MERRor:EPSK:TCH:CURRent?	–100.0 dB to +100.0 dB	query only	6.145
SAMPle:ARRAy:MODulation:MERRor:EPSK:TCH:CURRent?	–100.0 dB to +100.0 dB	query only	6.145
READ:SUBarrays:MODulation:MERRor:EPSK:TCH:CURRent?	–100.0 dB to +20.0 dB	query only	6.146
FETCh:SUBarrays:MODulation:MERRor:EPSK:TCH:CURRent?	–100.0 dB to +20.0 dB	query only	6.146
SAMPle:SUBarrays:MODulation:MERRor:EPSK:TCH:CURRent?	–100.0 dB to +20.0 dB	query only	6.146
CONFigure:MODulation:MERRor:EPSK:TCH:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.140
CALCulate[:SCALar]:MODulation:MERRor:EPSK:TCH:MATChing:LIMit?	<Result>	query only	6.144
READ:ARRAy:MODulation:MERRor:EPSK:TCH:MMAXimum?	–100.0 dB to +100.0 dB	query only	6.145

Command	Parameter	Remark	Page
FETCh:ARRAy:MODulation:MERRor:EPSK:TCH:MMAXimum?	–100.0 dB to +100.0 dB	query only	6.145
SAMPle:ARRAy:MODulation:MERRor:EPSK:TCH:MMAXimum?	–100.0 dB to +100.0 dB	query only	6.145
READ:SUBarrays:MODulation:MERRor:EPSK:TCH:MMAXimum?	–100.0 dB to +20.0 dB	query only	6.146
FETCh:SUBarrays:MODulation:MERRor:EPSK:TCH:MMAXimum?	–100.0 dB to +20.0 dB	query only	6.146
SAMPle:SUBarrays:MODulation:MERRor:EPSK:TCH:MMAXimum?	–100.0 dB to +20.0 dB	query only	6.146
FETCh:MODulation:MERRor:EPSK:TCH:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE , 1 to 1000 | NONE	query only	6.141
READ[:SCALar]:MODulation:MERRor:EPSK:TCH?	<Result>	query only	6.144
FETCh[:SCALar]:MODulation:MERRor:EPSK:TCH?	<Result>	query only	6.144
SAMPle[:SCALar]:MODulation:MERRor:EPSK:TCH?	<Result>	query only	6.144
CONFigure:MODulation:OEMP:EPSK:TCH:AVERage:LIMit[:SCALar]:SYMMetric[:COMBined]	<EVMErrorPeak>, <EVMErrorRMS>, <MagnErrorPeak>, <MagnErrorRMS>, <PhaseErrorPeak>, <PhaseErrorRMS>, <OriginOffset>, <IQImbalance>, <FreqError>	with query	6.123
CONFigure:MODulation:OEMP:EPSK:TCH:CMMax:LIMit[:SCALar]:SYMMetric[:COMBined]	<EVMErrorPeak>, <EVMErrorRMS>, <MagnErrorPeak>, <MagnErrorRMS>, <PhaseErrorPeak>, <PhaseErrorRMS>, <OriginOffset>, <IQImbalance>, <FreqError>	with query	6.123
DEFault:MODulation:OEMP:EPSK:TCH:LIMit	ON | OFF	with query	6.124
CONFigure:MODulation:OEMP:EPSK:TCH:P95th:LIMit[:SCALar]:SYMMetric[:COMBined]	<EVM95%>, <MError95%>, <PError95%>	with query	6.123
INITiate:MODulation:OVERview:EPSK:TCH	–	no query	6.120
ABORt:MODulation:OVERview:EPSK:TCH	–	no query	6.120
STOP:MODulation:OVERview:EPSK:TCH	–	no query	6.120
CONTinue:MODulation:OVERview:EPSK:TCH	–	no query	6.120
CONFigure:MODulation:OVERview:EPSK:TCH:CONTrol	SCALar | ARRay, 1 to 1000 | NONE, CONTinuous | SINGleshot | 1 to 10000, SOERror | NONE,STEP | NONE	with query	6.121
DEFault:MODulation:OVERview:EPSK:TCH:CONTrol	ON | OFF	with query	6.123
CONFigure:MODulation:OVERview:EPSK:TCH:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SOERror | NONE,	with query	6.122

Command	Parameter	Remark	Page
	STEP | NONE		
CONFigure:MODulation:OVERview:EPSK:TCH:CONTrol:RMODe	SCALar | ARRay	with query	6.122
CONFigure:MODulation:OVERview:EPSK:TCH:CONTrol:STATistics	1 to 1000 | NONE	with query	6.122
CONFigure:MODulation:OVERview:EPSK:TCH:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.120
CALCulate[:SCALar]:MODulation:OVERview:EPSK:TCH:MATChing:LIMit?	<Result>	query only	6.125
FETCh:MODulation:OVERview:EPSK:TCH:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE , 1 to 1000 | NONE	query only	6.121
READ[:SCALar]:MODulation:OVERview:EPSK:TCH?	<Result>	query only	6.124
FETCh[:SCALar]:MODulation:OVERview:EPSK:TCH?	<Result>	query only	6.124
SAMPle[:SCALar]:MODulation:OVERview:EPSK:TCH?	<Result>	query only	6.124
INITiate:MODulation:PERRor:EPSK:TCH	–	no query	6.133
ABORt:MODulation:PERRor:EPSK:TCH	–	no query	6.133
STOP:MODulation:PERRor:EPSK:TCH	–	no query	6.133
CONTinue:MODulation:PERRor:EPSK:TCH	–	no query	6.133
CONFigure:SUBarrays:MODulation:PERRor:EPSK:TCH	ALL | ARIThmetical | MINimum | MAXimum,<Start>,<Samples>{,<Start>,<Samples>}	with query	6.136
READ:ARRAy:MODulation:PERRor:EPSK:TCH:AVERage?	–100.0 dB to +100.0 dB	query only	6.138
FETCh:ARRAy:MODulation:PERRor:EPSK:TCH:AVERage?	–100.0 dB to +100.0 dB	query only	6.138
SAMPle:ARRAy:MODulation:PERRor:EPSK:TCH:AVERage?	–100.0 dB to +100.0 dB	query only	6.138
READ:SUBarrays:MODulation:PERRor:EPSK:TCH:AVERage?	–100.0 dB to +20.0 dB	query only	6.139
FETCh:SUBarrays:MODulation:PERRor:EPSK:TCH:AVERage?	–100.0 dB to +20.0 dB	query only	6.139
SAMPle:SUBarrays:MODulation:PERRor:EPSK:TCH:AVERage?	–100.0 dB to +20.0 dB	query only	6.139
CONFigure:MODulation:PERRor:EPSK:TCH:CONTrol	SCALar | ARRay, 1 to 1000 | NONE, CONTinuous | SINGleshot | 1 to 10000, SOERror | NONE,STEP | NONE	with query	6.134
DEFault:MODulation:PERRor:EPSK:TCH:CONTrol	ON | OFF	with query	6.136
CONFigure:MODulation:PERRor:EPSK:TCH:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SOERror | NONE, STEP | NONE	with query	6.135
CONFigure:MODulation:PERRor:EPSK:TCH:CONTrol:RMODe	SCALar | ARRay	with query	6.135

Command	Parameter	Remark	Page
CONFigure:MODulation:PERRor:EPSK:TCH:CONTrol:STATistics	1 to 1000 | NONE	with query	6.135
READ:ARRAy:MODulation:PERRor:EPSK:TCH:CURRent?	–100.0 dB to +100.0 dB	query only	6.138
FETCh:ARRAy:MODulation:PERRor:EPSK:TCH:CURRent?	–100.0 dB to +100.0 dB	query only	6.138
SAMPle:ARRAy:MODulation:PERRor:EPSK:TCH:CURRent?	–100.0 dB to +100.0 dB	query only	6.138
READ:SUBarrays:MODulation:PERRor:EPSK:TCH:CURRent?	–100.0 dB to +20.0 dB	query only	6.139
FETCh:SUBarrays:MODulation:PERRor:EPSK:TCH:CURRent?	–100.0 dB to +20.0 dB	query only	6.139
SAMPle:SUBarrays:MODulation:PERRor:EPSK:TCH:CURRent?	–100.0 dB to +20.0 dB	query only	6.139
CONFigure:MODulation:PERRor:EPSK:TCH:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.133
CALCulate[:SCALar]:MODulation:PERRor:EPSK:TCH:MATChing:LIMit?	<Result>	query only	6.138
READ:ARRAy:MODulation:PERRor:EPSK:TCH:MMAXimum?	–100.0 dB to +100.0 dB	query only	6.138
FETCh:ARRAy:MODulation:PERRor:EPSK:TCH:MMAXimum?	–100.0 dB to +100.0 dB	query only	6.138
SAMPle:ARRAy:MODulation:PERRor:EPSK:TCH:MMAXimum?	–100.0 dB to +100.0 dB	query only	6.138
READ:SUBarrays:MODulation:PERRor:EPSK:TCH:MMAXimum?	–100.0 dB to +20.0 dB	query only	6.139
FETCh:SUBarrays:MODulation:PERRor:EPSK:TCH:MMAXimum?	–100.0 dB to +20.0 dB	query only	6.139
SAMPle:SUBarrays:MODulation:PERRor:EPSK:TCH:MMAXimum?	–100.0 dB to +20.0 dB	query only	6.139
FETCh:MODulation:PERRor:EPSK:TCH:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE , 1 to 1000 | NONE	query only	6.134
READ[:SCALar]:MODulation:PERRor:EPSK:TCH?	<Result>	query only	6.137
FETCh[:SCALar]:MODulation:PERRor:EPSK:TCH?	<Result>	query only	6.137
SAMPle[:SCALar]:MODulation:PERRor:EPSK:TCH?	<Result>	query only	6.137
INITiate:MODulation:PERRor:GMSK:CCH	–	no query	6.111
ABORt:MODulation:PERRor:GMSK:CCH	–	no query	6.111
STOP:MODulation:PERRor:GMSK:CCH	–	no query	6.111
CONTinue:MODulation:PERRor:GMSK:CCH	–	no query	6.111
CONFigure:SUBarrays:MODulation:PERRor:GMSK:CCH	ALL | ARIThmetical | MINimum | MAXimum,<Start>,<Samples> {,<Start>,<Samples>}	with query	6.116
READ:ARRay:MODulation:PERRor:GMSK:CCH:[:CURRent]?	–100.0 deg to +100.0 deg	only query	6.118
READ:SUBarrays:MODulation:PERRor:GMSK:CCH:[:CURRent]?	–100.0 deg to +100.0 deg	only query	6.119

Command	Parameter	Remark	Page
CONFigure:MODulation:PERRor:GMSK:CCH:AVERage:LIMit[:SCALar]:SYMMetric[:COMBined]:VALue	0.0 deg to 50.0 deg, 0.0 deg to 50.0 deg, 0 Hz to 1 kHz	with query	6.114
READ:ARRay:MODulation:PERRor:GMSK:CCH:AVERage?	–100.0 deg to +100.0 deg	only query	6.118
FETCh:ARRay:MODulation:PERRor:GMSK:CCH:AVERage?	–100.0 deg to +100.0 deg	only query	6.118
SAMPle:ARRay:MODulation:PERRor:GMSK:CCH:AVERage?	–100.0 deg to +100.0 deg	only query	6.118
READ:SUBarrays:MODulation:PERRor:GMSK:CCH:AVERage?	–100.0 deg to +100.0 deg	only query	6.119
FETCh:SUBarrays:MODulation:PERRor:GMSK:CCH:AVERage?	–100.0 deg to +100.0 deg	only query	6.119
SAMPle:SUBarrays:MODulation:PERRor:GMSK:CCH:AVERage?	–100.0 deg to +100.0 deg	only query	6.119
CONFigure:MODulation:PERRor:GMSK:CCH:CMMax:LIMit[:SCALar]:SYMMetric[:COMBined]:VALue	0.0 deg to 50.0 deg, 0.0 deg to 50.0 deg, 0 Hz to 1 kHz	with query	6.114
CONFigure:MODulation:PERRor:GMSK:CCH:CONTrol	SCALar | ARRay, 1 to 1000 | NONE, CONTinuous | SINGleshot | 1 to 10000, SOERror | NONE,STEP | NONE	with query	6.112
DEFault:MODulation:PERRor:GMSK:CCH:CONTrol	ON | OFF	with query	6.114
CONFigure:MODulation:PERRor:GMSK:CCH:CONTrol:REPetition	1 to 10000, SOERror | NONE	with query	6.113
CONFigure:MODulation:PERRor:GMSK:CCH:CONTrol:RMODe	SCALar | ARRay	with query	6.113
CONFigure:MODulation:PERRor:GMSK:CCH:CONTrol:STATistics	1 to 1000 | NONE	with query	6.113
FETCh:ARRay:MODulation:PERRor:GMSK:CCH:CURRent?	–100.0 deg to +100.0 deg	only query	6.118
SAMPle:ARRay:MODulation:PERRor:GMSK:CCH:CURRent?	–100.0 deg to +100.0 deg	only query	6.118
FETCh:SUBarrays:MODulation:PERRor:GMSK:CCH:CURRent?	–100.0 deg to +100.0 deg	only query	6.119
SAMPle:SUBarrays:MODulation:PERRor:GMSK:CCH:CURRent?	–100.0 deg to +100.0 deg	only query	6.119
CONFigure:MODulation:PERRor:GMSK:CCH:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.111
DEFault:MODulation:PERRor:GMSK:CCH:LIMit	ON | OFF	with query	6.115
CALCulate[:SCALar]:MODulation:PERRor:GMSK:CCH:MATChing:LIMit?	<Result>	only query	6.118
READ:ARRay:MODulation:PERRor:GMSK:CCH:MMAXimum?	–100.0 deg to +100.0 deg	only query	6.118
FETCh:ARRay:MODulation:PERRor:GMSK:CCH:MMAXimum?	–100.0 deg to +100.0 deg	only query	6.118
SAMPle:ARRay:MODulation:PERRor:GMSK:CCH:MMAXimum?	–100.0 deg to +20.0 deg	only query	6.118
READ:SUBarrays:MODulation:PERRor:GMSK:CCH:MMAXimum?	–100.0 deg to +100.0 deg	only query	6.119
FETCh:SUBarrays:MODulation:PERRor:GMSK:CCH:MMAXimum?	–100.0 deg to +100.0 deg	only query	6.119
SAMPle:SUBarrays:MODulation:PERRor:GMSK:CCH:MMAXimum	–100.0 deg to +20.0 deg	only query	6.119

Command	Parameter	Remark	Page
?			
FETCh:MODulation:PERRor:GMSK:CCH:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE , 1 to 1000 | NONE	only query	6.112
CONFigure:MODulation:PERRor:GMSK:CCH:TIME:DECode	STANdard | GTBits	with query	6.115
READ[:SCALar]:MODulation:PERRor:GMSK:CCH?	<Result>	only query	6.117
FETCh[:SCALar]:MODulation:PERRor:GMSK:CCH?	<Result>	only query	6.117
SAMPle[:SCALar]:MODulation:PERRor:GMSK:CCH?	<Result>	only query	6.117
INITiate:MODulation:PERRor:GMSK:TCH	–	no query	6.111
ABORt:MODulation:PERRor:GMSK:TCH	–	no query	6.111
STOP:MODulation:PERRor:GMSK:TCH	–	no query	6.111
CONTinue:MODulation:PERRor:GMSK:TCH	–	no query	6.111
CONFigure:SUBarrays:MODulation:PERRor:GMSK:TCH	ALL | ARIThmetical | MINimum | MAXimum,<Start>,<Samples> {,<Start>,<Samples>}	with query	6.116
READ:ARRay:MODulation:PERRor:GMSK:TCH:[:CURRent]?	–100.0 deg to +100.0 deg	only query	6.118
READ:SUBarrays:MODulation:PERRor:GMSK:TCH:[:CURRent]?	–100.0 deg to +100.0 deg	only query	6.119
CONFigure:MODulation:PERRor:GMSK:TCH:AVERage:LIMit[:SCALar]:SYMMetric[:COMBined]:VALue	0.0 deg to 50.0 deg, 0.0 deg to 50.0 deg, 0 Hz to 1 kHz	with query	6.114
READ:ARRay:MODulation:PERRor:GMSK:TCH:AVERage?	–100.0 deg to +100.0 deg	only query	6.118
FETCh:ARRay:MODulation:PERRor:GMSK:TCH:AVERage?	–100.0 deg to +100.0 deg	only query	6.118
SAMPle:ARRay:MODulation:PERRor:GMSK:TCH:AVERage?	–100.0 deg to +100.0 deg	only query	6.118
READ:SUBarrays:MODulation:PERRor:GMSK:TCH:AVERage?	–100.0 deg to +100.0 deg	only query	6.119
FETCh:SUBarrays:MODulation:PERRor:GMSK:TCH:AVERage?	–100.0 deg to +100.0 deg	only query	6.119
SAMPle:SUBarrays:MODulation:PERRor:GMSK:TCH:AVERage?	–100.0 deg to +100.0 deg	only query	6.119
CONFigure:MODulation:PERRor:GMSK:TCH:CMMax:LIMit[:SCALar]:SYMMetric[:COMBined]:VALue	0.0 deg to 50.0 deg, 0.0 deg to 50.0 deg, 0 Hz to 1 kHz	with query	6.114
CONFigure:MODulation:PERRor:GMSK:TCH:CONTrol	SCALar | ARRay, 1 to 1000 | NONE, CONTinuous | SINGleshot | 1 to 10000, SOERror | NONE,STEP | NONE	with query	6.112
DEFault:MODulation:PERRor:GMSK:TCH:CONTrol	ON | OFF	with query	6.114
CONFigure:MODulation:PERRor:GMSK:TCH:CONTrol:REPetition	1 to 10000, SOERror | NONE	with query	6.113

Command	Parameter	Remark	Page
CONFigure:MODulation:PERRor:GMSK:TCH:CONTrol:RMODe	SCALar | ARRay	with query	6.113
CONFigure:MODulation:PERRor:GMSK:TCH:CONTrol:STATistics	1 to 1000 | NONE	with query	6.113
FETCh:ARRay:MODulation:PERRor:GMSK:TCH:CURRent?	–100.0 deg to +100.0 deg	only query	6.118
SAMPle:ARRay:MODulation:PERRor:GMSK:TCH:CURRent?	–100.0 deg to +100.0 deg	only query	6.118
FETCh:SUBarrays:MODulation:PERRor:GMSK:TCH:CURRent?	–100.0 deg to +100.0 deg	only query	6.119
SAMPle:SUBarrays:MODulation:PERRor:GMSK:TCH:CURRent?	–100.0 deg to +100.0 deg	only query	6.119
CONFigure:MODulation:PERRor:GMSK:TCH:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.111
DEFault:MODulation:PERRor:GMSK:TCH:LIMit	ON | OFF	with query	6.115
CALCulate[:SCALar]:MODulation:PERRor:GMSK:TCH:MATChing:LIMit?	<Result>	only query	6.118
READ:ARRay:MODulation:PERRor:GMSK:TCH:MMAXimum?	–100.0 deg to +100.0 deg	only query	6.118
FETCh:ARRay:MODulation:PERRor:GMSK:TCH:MMAXimum?	–100.0 deg to +100.0 deg	only query	6.118
SAMPle:ARRay:MODulation:PERRor:GMSK:TCH:MMAXimum?	–100.0 deg to +20.0 deg	only query	6.118
READ:SUBarrays:MODulation:PERRor:GMSK:TCH:MMAXimum?	–100.0 deg to +100.0 deg	only query	6.119
FETCh:SUBarrays:MODulation:PERRor:GMSK:TCH:MMAXimum?	–100.0 deg to +100.0 deg	only query	6.119
SAMPle:SUBarrays:MODulation:PERRor:GMSK:TCH:MMAXimum ?	–100.0 deg to +20.0 deg	only query	6.119
FETCh:MODulation:PERRor:GMSK:TCH:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE , 1 to 1000 | NONE	only query	6.112
CONFigure:MODulation:PERRor:GMSK:TCH:TIME:DECode	STANdard | GTBits	with query	6.115
READ[:SCALar]:MODulation:PERRor:GMSK:TCH?	<Result>	only query	6.117
FETCh[:SCALar]:MODulation:PERRor:GMSK:TCH?	<Result>	only query	6.117
SAMPle[:SCALar]:MODulation:PERRor:GMSK:TCH?	<Result>	only query	6.117
RF generator signal of CMU			
DEFault:MSSignal	ON | OFF	with query	6.84
CONFigure:MSSignal:BITStream	LOOP|ECHO|E9_1|E11_1|E15_1|E16_1|HAND	with query	6.83
CONFigure:MSSignal:LEVel:UNTimeslot	<Level>	with query	6.83
CONFigure:MSSignal:LEVel:UTIMeslot	<Level>	with query	6.83
CONFigure:MSSignal:OPMode	<Delay>	with query	6.83

Command	Parameter	Remark	Page
Network parameters			
CONFigure:NETWork:MREPort:AUTO:RXLevel	0 to 63	with query	6.87
CONFigure:NETWork:MREPort:AUTO:RXLQ	0 to 7, 0 to 63	with query	6.88
CONFigure:NETWork:MREPort:AUTO:RXOFfset		with query	6.88
CONFigure:NETWork:MREPort:MANual:RXLevel	0 to 63	with query	6.87
CONFigure:NETWork:MREPort:MANUal:RXQuality	0 to 7	with query	6.87
CONFigure:NETWork:MREPort:MODE	MANual | AUTO	with query	6.87
CONFigure:NETWork:SUBScriberid:DNUMber	0 .. n	with query	6.86
CONFigure:NETWork:SUBScriberid:I	6 (7) to 15 digits	with query	6.86
CONFigure:NETWork:SUBScriberid:IMEI	15 digits	with query	6.86
CONFigure:NETWork:SUBScriberid:SCPin	0 to ???	with query	6.85
CONFigure:NETWork[:MS]:AUTohookoff	1.0 s to 100.0 s	with query	6.85
DEFault:NETWork	ON | OFF	with query	6.85
Power measurements			
INITiate:POWer:NBURst:EPSK:TCH	–	no query	6.93
ABORt:POWer:NBURst:EPSK:TCH	–	no query	6.93
STOP:POWer:NBURst:EPSK:TCH	–	no query	6.93
CONTinue:POWer:NBURst:EPSK:TCH	–	no query	6.93
CONFigure:SUBarrays:POWer:NBURst:EPSK:TCH	ALL | ARITHmetical | MINimum | MAXimum,<Start>,<Samples> {,<Start>,<Samples>}	with query	6.102
CALCulate:ARRay:POWer:NBURst:EPSK:TCH:AVERage:MATChing:AREA?	<Matching>	query only	6.107
CALCulate:ARRay:POWer:NBURst:EPSK:TCH:AVERage:MATChing:LIMit?	<Matching>	only query	6.106
READ:ARRay:POWer:NBURst:EPSK:TCH:AVERage?	–100.0 dB to +20 dB	only query	6.104
FETCh:ARRay:POWer:NBURst:EPSK:TCH:AVERage?	–100.0 dB to +20 dB	only query	6.104
SAMPle:ARRay:POWer:NBURst:EPSK:TCH:AVERage?	–100.0 dB to +20 dB	only query	6.105
READ:SUBarrays:POWer:NBURst:EPSK:TCH:AVERage?	–100.0 dB to +20 dB	only query	6.105
FETCh:SUBarrays:POWer:NBURst:EPSK:TCH:AVERage?	–100.0 dB to +20 dB	only query	6.105

Command	Parameter	Remark	Page
SAMPle:SUBarrays:POWer:NBURst:EPSK:TCH:AVERage?	–100.0 dB to +20 dB	only query	6.106
CONFigure:POWer:NBURst:EPSK:TCH:CONTrol	SCALar | ARRay, 1 to 1000 | NONE, CONTinuous | SINGleshot | 1 to 10000, SOERror | NONE,STEP | NONE	with query	6.94
DEFault:POWer:NBURst:EPSK:TCH:CONTrol	ON | OFF	with query	6.96
CONFigure:POWer:NBURst:EPSK:TCH:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SOERror | NONE,STEP | NONE	with query	6.96
CONFigure:POWer:NBURst:EPSK:TCH:CONTrol:RMODe	SCALar | ARRay	with query	6.95
CONFigure:POWer:NBURst:EPSK:TCH:CONTrol:STATistics	1 to 1000 | NONE	with query	6.95
CALCulate:ARRay:POWer:NBURst:EPSK:TCH:CURRent:MATChing:AREA?	<Matching>	query only	6.107
CALCulate:ARRay:POWer:NBURst:EPSK:TCH:CURRent:MATChing:LIMit?	<Matching>	only query	6.106
READ:ARRay:POWer:NBURst:EPSK:TCH:CURRent?	–100.0 dB to +20 dB	only query	6.104
FETCh:ARRay:POWer:NBURst:EPSK:TCH:CURRent?	–100.0 dB to +20 dB	only query	6.104
SAMPle:ARRay:POWer:NBURst:EPSK:TCH:CURRent?	–100.0 dB to +20 dB	only query	6.105
READ:SUBarrays:POWer:NBURst:EPSK:TCH:CURRent?	–100.0 dB to +20 dB	only query	6.105
FETCh:SUBarrays:POWer:NBURst:EPSK:TCH:CURRent?	–100.0 dB to +20 dB	only query	6.105
SAMPle:SUBarrays:POWer:NBURst:EPSK:TCH:CURRent?	–100.0 dB to +20 dB	only query	6.105
CONFigure:POWer:NBURst:EPSK:TCH:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.94
DEFault:POWer:NBURst:EPSK:TCH:LIMit:LINE	ON | OFF	with query	6.100
CONFigure:POWer:NBURst:EPSK:TCH:LIMit:LINE:ASYMmetric:LOWer:AREA<nr>	<StartTime>, <EndTime>, <StartRelLevel>, <EndRelLevel>, <StartAbsLevel>, <EndAbsLevel>, <Visibility>	with query	6.99
CONFigure:POWer:NBURst:EPSK:TCH:LIMit:LINE:ASYMmetric:LOWer:AREA<nr>:VALue	<StartTime>, <EndTime>, <StartRelLevel>, <EndRelLevel>, <StartAbsLevel>, <EndAbsLevel>	with query	6.99
CONFigure:POWer:NBURst:EPSK:TCH:LIMit:LINE:ASYMmetric:LOWer:AREA<nr>:VALue:ENABle	ON | OFF	with query	6.99
CONFigure:POWer:NBURst:EPSK:TCH:LIMit:LINE:ASYMmetric:LOWer:ENABle	ON | OFF	with query	6.100
CONFigure:POWer:NBURst:EPSK:TCH:LIMit:LINE:ASYMmetric:UPPer:AREA<nr>	<StartTime>, <EndTime>, <StartRelLevel>, <EndRelLevel>,	with query	6.97

Command	Parameter	Remark	Page
	<StartAbsLevel>, <EndAbsLevel>, <Visibility>		
CONFigure:POWer:NBURst:EPSK:TCH:LIMit:LINE:ASYMmetric:UPPer:AREA<nr>:VALue	<StartTime>, <EndTime>, <StartRelLevel>, <EndRelLevel>, <StartAbsLevel>, <EndAbsLevel>	with query	6.97
CONFigure:POWer:NBURst:EPSK:TCH:LIMit:LINE:ASYMmetric:UPPer:AREA<nr>:VALue:ENABle	ON | OFF	with query	6.97
CONFigure:POWer:NBURst:EPSK:TCH:LIMit:LINE:ASYMmetric:UPPer:ENABle	ON | OFF	with query	6.100
CALCulate[:SCALar]:POWer:NBURst:EPSK:TCH:MATChing:LIMit?	<Result>	only query	6.104
CALCulate:ARRay:POWer:NBURst:EPSK:TCH:MAXimum:MATChing:AREA?	<Matching>	query only	6.107
CALCulate:ARRay:POWer:NBURst:EPSK:TCH:MAXimum:MATChing:LIMit?	<Matching>	only query	6.106
READ:ARRay:POWer:NBURst:EPSK:TCH:MAXimum?	–100.0 dB to +20 dB	only query	6.104
FETCh:ARRay:POWer:NBURst:EPSK:TCH:MAXimum?	–100.0 dB to +20 dB	only query	6.104
SAMPle:ARRay:POWer:NBURst:EPSK:TCH:MAXimum?	–100.0 dB to +20.0 dB	only query	6.105
READ:SUBarrays:POWer:NBURst:EPSK:TCH:MAXimum?	–100.0 dB to +20 dB	only query	6.105
FETCh:SUBarrays:POWer:NBURst:EPSK:TCH:MAXimum?	–100.0 dB to +20 dB	only query	6.105
SAMPle:SUBarrays:POWer:NBURst:EPSK:TCH:MAXimum?	–100.0 dB to +20.0 dB	only query	6.106
CALCulate:ARRay:POWer:NBURst:EPSK:TCH:MINimum:MATChing:AREA?	<Matching>	query only	6.107
CALCulate:ARRay:POWer:NBURst:EPSK:TCH:MINimum:MATChing:LIMit?	<Matching>	only query	6.106
READ:ARRay:POWer:NBURst:EPSK:TCH:MINimum?	–100.0 dB to +20 dB	only query	6.104
FETCh:ARRay:POWer:NBURst:EPSK:TCH:MINimum?	–100.0 dB to +20 dB	only query	6.105
SAMPle:ARRay:POWer:NBURst:EPSK:TCH:MINimum?	–100.0 dB to +20.0 dB	only query	6.105
READ:SUBarrays:POWer:NBURst:EPSK:TCH:MINimum?	–100.0 dB to +20 dB	only query	6.105
FETCh:SUBarrays:POWer:NBURst:EPSK:TCH:MINimum?	–100.0 dB to +20 dB	only query	6.105
SAMPle:SUBarrays:POWer:NBURst:EPSK:TCH:MINimum?	–100.0 dB to +20.0 dB	only query	6.106
CONFigure:POWer:NBURst:EPSK:TCH:RPMode	CURRent | AVERage | DCOMpensated	with query	6.101
FETCh:POWer:NBURst:EPSK:TCH:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE , 1 to 1000 | NONE	only query	6.94

Command	Parameter	Remark	Page
CONFigure:POWer:NBURst:EPSK:TCH:TIME:BOFFset	????	with query	6.101
READ[:SCALar]:POWer:NBURst:EPSK:TCH?	<Result>	only query	6.103
FETCh[:SCALar]:POWer:NBURst:EPSK:TCH?	<Result>	only query	6.103
SAMPle[:SCALar]:POWer:NBURst:EPSK:TCH?	<Result>	only query	6.103
INITiate:POWer:NBURst:GMSK:CCH	–	no query	6.93
ABORt:POWer:NBURst:GMSK:CCH	–	no query	6.93
STOP:POWer:NBURst:GMSK:CCH	–	no query	6.93
CONTinue:POWer:NBURst:GMSK:CCH	–	no query	6.93
CONFigure:SUBarrays:POWer:NBURst:GMSK:CCH	ALL | ARITHmetical | MINimum | MAXimum,<Start>,<Samples> {,<Start>,<Samples>}	with query	6.102
CALCulate:ARRay:POWer:NBURst:GMSK:CCH:AVERage:MATChing:AREA?	<Matching>	query only	6.107
CALCulate:ARRay:POWer:NBURst:GMSK:CCH:AVERage:MATChing:LIMit?	<Matching>	only query	6.106
READ:ARRay:POWer:NBURst:GMSK:CCH:AVERage?	–100.0 dB to +20 dB	only query	6.104
FETCh:ARRay:POWer:NBURst:GMSK:CCH:AVERage?	–100.0 dB to +20 dB	only query	6.104
SAMPle:ARRay:POWer:NBURst:GMSK:CCH:AVERage?	–100.0 dB to +20 dB	only query	6.105
READ:SUBarrays:POWer:NBURst:GMSK:CCH:AVERage?	–100.0 dB to +20 dB	only query	6.105
FETCh:SUBarrays:POWer:NBURst:GMSK:CCH:AVERage?	–100.0 dB to +20 dB	only query	6.105
SAMPle:SUBarrays:POWer:NBURst:GMSK:CCH:AVERage?	–100.0 dB to +20 dB	only query	6.106
CONFigure:POWer:NBURst:GMSK:CCH:CONTrol	SCALar | ARRay, 1 to 1000 | NONE, CONTinuous | SINGleshot | 1 to 10000, SOERror | NONE,STEP | NONE	with query	6.94
DEFault:POWer:NBURst:GMSK:CCH:CONTrol	ON | OFF	with query	6.96
CONFigure:POWer:NBURst:GMSK:CCH:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SOERror | NONE,STEP | NONE	with query	6.96
CONFigure:POWer:NBURst:GMSK:CCH:CONTrol:RMODe	SCALar | ARRay	with query	6.95
CONFigure:POWer:NBURst:GMSK:CCH:CONTrol:STATistics	1 to 1000 | NONE	with query	6.95
CALCulate:ARRay:POWer:NBURst:GMSK:CCH:CURRent:MATChing:AREA?	<Matching>	query only	6.107
CALCulate:ARRay:POWer:NBURst:GMSK:CCH:CURRent:MATChi	<Matching>	only query	6.106

Command	Parameter	Remark	Page
ng:LIMit?			
READ:ARRay:POWer:NBURst:GMSK:CCH:CURRent?	–100.0 dB to +20 dB	only query	6.104
FETCh:ARRay:POWer:NBURst:GMSK:CCH:CURRent?	–100.0 dB to +20 dB	only query	6.104
SAMPle:ARRay:POWer:NBURst:GMSK:CCH:CURRent?	–100.0 dB to +20 dB	only query	6.105
READ:SUBarrays:POWer:NBURst:GMSK:CCH:CURRent?	–100.0 dB to +20 dB	only query	6.105
FETCh:SUBarrays:POWer:NBURst:GMSK:CCH:CURRent?	–100.0 dB to +20 dB	only query	6.105
SAMPle:SUBarrays:POWer:NBURst:GMSK:CCH:CURRent?	–100.0 dB to +20 dB	only query	6.105
CONFigure:POWer:NBURst:GMSK:CCH:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.94
DEFault:POWer:NBURst:GMSK:CCH:LIMit:LINE	ON | OFF	with query	6.100
CONFigure:POWer:NBURst:GMSK:CCH:LIMit:LINE:ASYMmetric:LOWer:AREA<nr>	<StartTime>, <EndTime>, <StartRelLevel>, <EndRelLevel>, <StartAbsLevel>, <EndAbsLevel>, <Visibility>	with query	6.99
CONFigure:POWer:NBURst:GMSK:CCH:LIMit:LINE:ASYMmetric:LOWer:AREA<nr>:VALue	<StartTime>, <EndTime>, <StartRelLevel>, <EndRelLevel>, <StartAbsLevel>, <EndAbsLevel>	with query	6.99
CONFigure:POWer:NBURst:GMSK:CCH:LIMit:LINE:ASYMmetric:LOWer:AREA<nr>:VALue:ENABle	ON | OFF	with query	6.99
CONFigure:POWer:NBURst:GMSK:CCH:LIMit:LINE:ASYMmetric:LOWer:ENABle	ON | OFF	with query	6.100
CONFigure:POWer:NBURst:GMSK:CCH:LIMit:LINE:ASYMmetric:UPPer:AREA<nr>	<StartTime>, <EndTime>, <StartRelLevel>, <EndRelLevel>, <StartAbsLevel>, <EndAbsLevel>, <Visibility>	with query	6.97
CONFigure:POWer:NBURst:GMSK:CCH:LIMit:LINE:ASYMmetric:UPPer:AREA<nr>:VALue	<StartTime>, <EndTime>, <StartRelLevel>, <EndRelLevel>, <StartAbsLevel>, <EndAbsLevel>	with query	6.97
CONFigure:POWer:NBURst:GMSK:CCH:LIMit:LINE:ASYMmetric:UPPer:AREA<nr>:VALue:ENABle	ON | OFF	with query	6.97
CONFigure:POWer:NBURst:GMSK:CCH:LIMit:LINE:ASYMmetric:UPPer:ENABle	ON | OFF	with query	6.100
CALCulate[:SCALar]:POWer:NBURst:GMSK:CCH:MATChing:LIMit?	<Result>	only query	6.104
CALCulate:ARRay:POWer:NBURst:GMSK:CCH:MAXimum:MATChing:AREA?	<Matching>	query only	6.107
CALCulate:ARRay:POWer:NBURst:GMSK:CCH:MAXimum:MATCh	<Matching>	only query	6.106

Command	Parameter	Remark	Page
ing:LIMit?			
READ:ARRay:POWer:NBURst:GMSK:CCH:MAXimum?	–100.0 dB to +20 dB	only query	6.104
FETCh:ARRay:POWer:NBURst:GMSK:CCH:MAXimum?	–100.0 dB to +20 dB	only query	6.104
SAMPle:ARRay:POWer:NBURst:GMSK:CCH:MAXimum?	–100.0 dB to +20.0 dB	only query	6.105
READ:SUBarrays:POWer:NBURst:GMSK:CCH:MAXimum?	–100.0 dB to +20 dB	only query	6.105
FETCh:SUBarrays:POWer:NBURst:GMSK:CCH:MAXimum?	–100.0 dB to +20 dB	only query	6.105
SAMPle:SUBarrays:POWer:NBURst:GMSK:CCH:MAXimum?	–100.0 dB to +20.0 dB	only query	6.106
CALCulate:ARRay:POWer:NBURst:GMSK:CCH:MINimum:MATChing:AREA?	<Matching>	query only	6.107
CALCulate:ARRay:POWer:NBURst:GMSK:CCH:MINimum:MATChing:LIMit?	<Matching>	only query	6.106
READ:ARRay:POWer:NBURst:GMSK:CCH:MINimum?	–100.0 dB to +20 dB	only query	6.104
FETCh:ARRay:POWer:NBURst:GMSK:CCH:MINimum?	–100.0 dB to +20 dB	only query	6.105
SAMPle:ARRay:POWer:NBURst:GMSK:CCH:MINimum?	–100.0 dB to +20.0 dB	only query	6.105
READ:SUBarrays:POWer:NBURst:GMSK:CCH:MINimum?	–100.0 dB to +20 dB	only query	6.105
FETCh:SUBarrays:POWer:NBURst:GMSK:CCH:MINimum?	–100.0 dB to +20 dB	only query	6.105
SAMPle:SUBarrays:POWer:NBURst:GMSK:CCH:MINimum?	–100.0 dB to +20.0 dB	only query	6.106
FETCh:POWer:NBURst:GMSK:CCH:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE , 1 to 1000 | NONE	only query	6.94
CONFigure:POWer:NBURst:GMSK:CCH:TIME:BOFFset	????	with query	6.101
READ[:SCALar]:POWer:NBURst:GMSK:CCH?	<Result>	only query	6.103
FETCh[:SCALar]:POWer:NBURst:GMSK:CCH?	<Result>	only query	6.103
SAMPle[:SCALar]:POWer:NBURst:GMSK:CCH?	<Result>	only query	6.103
INITiate:POWer:NBURst:GMSK:TCH	–	no query	6.93
ABORt:POWer:NBURst:GMSK:TCH	–	no query	6.93
STOP:POWer:NBURst:GMSK:TCH	–	no query	6.93
CONTinue:POWer:NBURst:GMSK:TCH	–	no query	6.93
CONFigure:SUBarrays:POWer:NBURst:GMSK:TCH	ALL | ARITHmetical | MINimum | MAXimum,<Start>,<Samples> {,<Start>,<Samples>}	with query	6.102
CALCulate:ARRay:POWer:NBURst:GMSK:TCH:AVERage:MATChing:AREA?	<Matching>	query only	6.107

Command	Parameter	Remark	Page
CALCulate:ARRay:POWer:NBURst:GMSK:TCH:AVERage:MATChing:LIMit?	<Matching>	only query	6.106
READ:ARRay:POWer:NBURst:GMSK:TCH:AVERage?	–100.0 dB to +20 dB	only query	6.104
FETCh:ARRay:POWer:NBURst:GMSK:TCH:AVERage?	–100.0 dB to +20 dB	only query	6.104
SAMPle:ARRay:POWer:NBURst:GMSK:TCH:AVERage?	–100.0 dB to +20 dB	only query	6.105
READ:SUBarrays:POWer:NBURst:GMSK:TCH:AVERage?	–100.0 dB to +20 dB	only query	6.105
FETCh:SUBarrays:POWer:NBURst:GMSK:TCH:AVERage?	–100.0 dB to +20 dB	only query	6.105
SAMPle:SUBarrays:POWer:NBURst:GMSK:TCH:AVERage?	–100.0 dB to +20 dB	only query	6.106
CONFigure:POWer:NBURst:GMSK:TCH:CONTrol	SCALar | ARRay, 1 to 1000 | NONE, CONTinuous | SINGleshot | 1 to 10000, SOERror | NONE,STEP | NONE	with query	6.94
DEFault:POWer:NBURst:GMSK:TCH:CONTrol	ON | OFF	with query	6.96
CONFigure:POWer:NBURst:GMSK:TCH:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SOERror | NONE,STEP | NONE	with query	6.96
CONFigure:POWer:NBURst:GMSK:TCH:CONTrol:RMODe	SCALar | ARRay	with query	6.95
CONFigure:POWer:NBURst:GMSK:TCH:CONTrol:STATistics	1 to 1000 | NONE	with query	6.95
CALCulate:ARRay:POWer:NBURst:GMSK:TCH:CURRent:MATChing:AREA?	<Matching>	query only	6.107
CALCulate:ARRay:POWer:NBURst:GMSK:TCH:CURRent:MATChing:LIMit?	<Matching>	only query	6.106
READ:ARRay:POWer:NBURst:GMSK:TCH:CURRent?	–100.0 dB to +20 dB	only query	6.104
FETCh:ARRay:POWer:NBURst:GMSK:TCH:CURRent?	–100.0 dB to +20 dB	only query	6.104
SAMPle:ARRay:POWer:NBURst:GMSK:TCH:CURRent?	–100.0 dB to +20 dB	only query	6.105
READ:SUBarrays:POWer:NBURst:GMSK:TCH:CURRent?	–100.0 dB to +20 dB	only query	6.105
FETCh:SUBarrays:POWer:NBURst:GMSK:TCH:CURRent?	–100.0 dB to +20 dB	only query	6.105
SAMPle:SUBarrays:POWer:NBURst:GMSK:TCH:CURRent?	–100.0 dB to +20 dB	only query	6.105
CONFigure:POWer:NBURst:GMSK:TCH:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.94
DEFault:POWer:NBURst:GMSK:TCH:LIMit:LINE	ON | OFF	with query	6.100
CONFigure:POWer:NBURst:GMSK:TCH:LIMit:LINE:ASYMmetric:LOWer:AREA<nr>	<StartTime>, <EndTime>, <StartRelLevel>, <EndRelLevel>, <StartAbsLevel>, <EndAbsLevel>, <Visibility>	with query	6.99

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CONFigure:POWer:NBURst:GMSK:TCH:LIMit:LINE:ASYMmetric:LOWer:AREA<nr>:VALue	<StartTime>, <EndTime>, <StartRelLevel>, <EndRelLevel>, <StartAbsLevel>, <EndAbsLevel>	with query	6.99
CONFigure:POWer:NBURst:GMSK:TCH:LIMit:LINE:ASYMmetric:LOWer:AREA<nr>:VALue:ENABle	ON | OFF	with query	6.99
CONFigure:POWer:NBURst:GMSK:TCH:LIMit:LINE:ASYMmetric:LOWer:ENABle	ON | OFF	with query	6.100
CONFigure:POWer:NBURst:GMSK:TCH:LIMit:LINE:ASYMmetric:UPPer:AREA<nr>	<StartTime>, <EndTime>, <StartRelLevel>, <EndRelLevel>, <StartAbsLevel>, <EndAbsLevel>, <Visibility>	with query	6.97
CONFigure:POWer:NBURst:GMSK:TCH:LIMit:LINE:ASYMmetric:UPPer:AREA<nr>:VALue	<StartTime>, <EndTime>, <StartRelLevel>, <EndRelLevel>, <StartAbsLevel>, <EndAbsLevel>	with query	6.97
CONFigure:POWer:NBURst:GMSK:TCH:LIMit:LINE:ASYMmetric:UPPer:AREA<nr>:VALue:ENABle	ON | OFF	with query	6.97
CONFigure:POWer:NBURst:GMSK:TCH:LIMit:LINE:ASYMmetric:UPPer:ENABle	ON | OFF	with query	6.100
CALCulate[:SCALar]:POWer:NBURst:GMSK:TCH:MATChing:LIMit?	<Result>	only query	6.104
CALCulate:ARRay:POWer:NBURst:GMSK:TCH:MAXimum:MATChing:AREA?	<Matching>	query only	6.107
CALCulate:ARRay:POWer:NBURst:GMSK:TCH:MAXimum:MATChing:LIMit?	<Matching>	only query	6.106
READ:ARRay:POWer:NBURst:GMSK:TCH:MAXimum?	–100.0 dB to +20 dB	only query	6.104
FETCh:ARRay:POWer:NBURst:GMSK:TCH:MAXimum?	–100.0 dB to +20 dB	only query	6.104
SAMPle:ARRay:POWer:NBURst:GMSK:TCH:MAXimum?	–100.0 dB to +20.0 dB	only query	6.105
READ:SUBarrays:POWer:NBURst:GMSK:TCH:MAXimum?	–100.0 dB to +20 dB	only query	6.105
FETCh:SUBarrays:POWer:NBURst:GMSK:TCH:MAXimum?	–100.0 dB to +20 dB	only query	6.105
SAMPle:SUBarrays:POWer:NBURst:GMSK:TCH:MAXimum?	–100.0 dB to +20.0 dB	only query	6.106
CALCulate:ARRay:POWer:NBURst:GMSK:TCH:MINimum:MATChing:AREA?	<Matching>	query only	6.107
CALCulate:ARRay:POWer:NBURst:GMSK:TCH:MINimum:MATChing:LIMit?	<Matching>	only query	6.106
READ:ARRay:POWer:NBURst:GMSK:TCH:MINimum?	–100.0 dB to +20 dB	only query	6.104
FETCh:ARRay:POWer:NBURst:GMSK:TCH:MINimum?	–100.0 dB to +20 dB	only query	6.105

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SAMPle:ARRay:POWer:NBURst:GMSK:TCH:MINimum?	–100.0 dB to +20.0 dB	only query	6.105
READ:SUBarrays:POWer:NBURst:GMSK:TCH:MINimum?	–100.0 dB to +20 dB	only query	6.105
FETCh:SUBarrays:POWer:NBURst:GMSK:TCH:MINimum?	–100.0 dB to +20 dB	only query	6.105
SAMPle:SUBarrays:POWer:NBURst:GMSK:TCH:MINimum?	–100.0 dB to +20.0 dB	only query	6.106
FETCh:POWer:NBURst:GMSK:TCH:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE , 1 to 1000 | NONE	only query	6.94
CONFigure:POWer:NBURst:GMSK:TCH:TIME:BOFFset	????	with query	6.101
READ[:SCALar]:POWer:NBURst:GMSK:TCH?	<Result>	only query	6.103
FETCh[:SCALar]:POWer:NBURst:GMSK:TCH?	<Result>	only query	6.103
SAMPle[:SCALar]:POWer:NBURst:GMSK:TCH?	<Result>	only query	6.103
INITiate:POWer:SLOT:GMSK:TCH	–	no query	6.108
ABORt:POWer:SLOT:GMSK:TCH	–	no query	6.108
STOP:POWer:SLOT:GMSK:TCH	–	no query	6.108
CONTinue:Power:SLOT:GMSK:TCH	–	no query	6.108
DEFault:POWer:SLOT:GMSK:TCH:CONTrol	ON | OFF	with query	6.109
CONFigure:POWer:SLOT:GMSK:TCH:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SOERror | NONE, STEP | NONE	with query	6.109
CONFigure:POWer:SLOT:GMSK:TCH:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.108
FETCh:POWer:SLOT:GMSK:TCH:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE	query only	6.108
READ[:SCALar]:POWer:SLOT:GMSK:TCH?	<Result>	query only	6.110
FETCh[:SCALar]:POWer:SLOT:GMSK:TCH?	<Result>	query only	6.110
SAMPle[:SCALar]:POWer:SLOT:GMSK:TCH?	<Result>	query only	6.110
Sensitivity measurements			
INITiate:RXQuality:BAVerage	–	no query	6.173
ABORt:RXQuality:BAVerage	–	no query	6.173
STOP:RXQuality:BAVerage	–	no query	6.173
CONTinue:RXQuality:BAVerage	–	no query	6.173
CONFigure:RXQuality:BAVerage:CONTrol	RFER | BER | BBBurst | RUFR | RESidr | REVSidr, 0 to	with query	6.174

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	500|OFF		
DEFault:RXQuality:BAVerage:CONTrol	ON | OFF	with query	6.175
CONFigure:RXQuality:BAVerage:CONTrol:REPetition	FLIMit | ALIMits | NONE, STEP | NONE	with query	6.174
CONFigure:RXQuality:BAVerage:CONTrol[:TCH]:LEVel:UNTimeslot	–127 dB to +127 dB	with query	6.175
CONFigure:RXQuality:BAVerage:CONTrol[:TCH]:LEVel:UTIMeslot	<Level>	with query	6.174
CONFigure:RXQuality:BAVerage:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.173
CONFigure:RXQuality:BAVerage:LIMit:CLIB	0 % to 100 %	with query	6.175
CONFigure:RXQuality:BAVerage:LIMit:CLII	0 % to 100 %	with query	6.175
CALCulate:RXQuality:BAVerage:MATChing:LIMit?	<Result>	only query	6.177
FETCh:RXQuality:BAVerage:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 500 | NONE	only query	6.173
READ[:SCALar]:RXQuality:BAVerage?	<Result>	only query	6.176
FETCh[:SCALar]:RXQuality:BAVerage?	<Result>	only query	6.176
SAMPle[:SCALar]:RXQuality:BAVerage?	<Result>	only query	6.176
DEFault:RXQuality:BAVerageLIMit	ON | OFF	with query	6.176
CONFigure:RXQuality:BAVerageLIMit:FERRors	0 % to 100 %	with query	6.176
INITiate:RXQuality:BER	–	no query	6.167
ABORt:RXQuality:BER	–	no query	6.167
STOP:RXQuality:BER	–	no query	6.167
CONTinue:RXQuality:BER	–	no query	6.167
CONFigure:RXQuality:BER:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.167
CALCulate:RXQuality:BER:MATChing:LIMit?	<Result>	only query	6.172
FETCh:RXQuality:BER:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 50000 | NONE	only query	6.168
CONFigure:RXQuality:BER:TSETup	T1 | T2 | T3 | T4 | T5 | T6 | T7 | T8 | T9 | T10	with query	6.167
READ[:SCALar]:RXQuality:BER?	<Result>	only query	6.171
FETCh[:SCALar]:RXQuality:BER?	<Result>	only query	6.171
SAMPle[:SCALar]:RXQuality:BER?	<Result>	only query	6.171
CONFigure:RXQuality:BER<nr>:CONTrol	RFER | BER , 0 to 50000|OFF	with query	6.168

Command	Parameter	Remark	Page
DEFault:RXQuality:BER<nr>:CONTrol	ON | OFF	with query	6.170
CONFigure:RXQuality:BER<nr>:CONTrol:REPetition	ALIMits | FLIMit | NONE, STEP | NONE	with query	6.169
CONFigure:RXQuality:BER<nr>:CONTrol[:TCH]:LEVel:UNTimeslot	–127 dB to +127 dB	with query	6.169
CONFigure:RXQuality:BER<nr>:CONTrol[:TCH]:LEVel:UTIMeslot	<Level>	with query	6.169
DEFault:RXQuality:BER<nr>:LIMit	ON | OFF	with query	6.171
CONFigure:RXQuality:BER<nr>:LIMit:CLIB	0 % to 100 %	with query	6.170
CONFigure:RXQuality:BER<nr>:LIMit:CLII	0 % to 100 %	with query	6.170
CONFigure:RXQuality:BER<nr>:LIMit:FERRors	0 % to 100 %	with query	6.170
CONFigure:RXQuality:CONTrol:HTIMe	1 s to 100 s, 1 s to 100 s	with query	6.166
Signalling			
PROCedure:SIGNalling:ACTion	SRUN | SSTP | CCH | TCH | LUP | SLUP | RLUP | MOC | SMOC | RMOC | SCR | CREL	with query	6.77
CONFigure:SIGNalling:SMODe	<Mode>	with query	6.79
[SENSe:]SIGNalling:STATe?	CCH | UNS | TCH | SIP | LUIP | LUF | CEST | CREL | CRIP | CRF | MOCP | MOCF | MTCP | MTCF	query only	6.78
Spectrum due to modulation measurements			
CONFigure:SPECtrum[:COMMon]:NOISe:CORRection	ON | OFF	with query	6.147
READ[:SCALar]:SPECtrum:Modulation:CCH?	<Result>	only query	6.155
INITiate:SPECtrum:MODulation:EPSK:TCH	–	no query	6.147
ABORt:SPECtrum:MODulation:EPSK:TCH	–	no query	6.147
STOP:SPECtrum:MODulation:EPSK:TCH	–	no query	6.147
CONTinue:SPECtrum:MODulation:EPSK:TCH	–	no query	6.147
CONFigure:SUBarrays:SPECtrum:MODulation:EPSK:TCH	ALL | ARIThmetical | MINimum | MAXimum,<Start>,<Samples> {,<Start>,<Samples>}	with query	6.154
CONFigure:SPECtrum:MODulation:EPSK:TCH:CONTrol	SCALar | ARRay, 1 to 1000 | NONE, CONTinuous | SINGleshot | 1 to 10000, SOERror | NONE,STEP | NONE	with query	6.148
DEFault:SPECtrum:MODulation:EPSK:TCH:CONTrol	ON | OFF	with query	6.150

Command	Parameter	Remark	Page
CONFigure:SPECtrum:MODulation:EPSK:TCH:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SOERror | NONE, STEP | NONE	with query	6.150
CONFigure:SPECtrum:MODulation:EPSK:TCH:CONTrol:RMODe	SCALar | ARRay	with query	6.149
CONFigure:SPECtrum:MODulation:EPSK:TCH:CONTrol:STATistics	1 to 1000 | NONE	with query	6.149
CONFigure:SPECtrum:MODulation:EPSK:TCH:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.148
DEFault:SPECtrum:MODulation:EPSK:TCH:LIMit:LINE	ON | OFF	with query	6.153
CONFigure:SPECtrum:MODulation:EPSK:TCH:LIMit:LINE:SYMMetric[:COMBined]:ENABle	ON | OFF	with query	6.152
CONFigure:SPECtrum:MODulation:EPSK:TCH:LIMit:LINE:SYMMetric[:COMBined]:FREQuency<nr>	<MinLevel>,<MaxLevel>,<Abs Level>,<Enable>	with query	6.151
CONFigure:SPECtrum:MODulation:EPSK:TCH:LIMit:LINE:SYMMetric[:COMBined]:FREQuency<nr>:ENABle	ON | OFF	with query	6.151
CONFigure:SPECtrum:MODulation:EPSK:TCH:LIMit:LINE:SYMMetric[:COMBined]:FREQuency<nr>	<MinLevel>,<MaxLevel>,<Abs Level>	with query	6.151
CONFigure:SPECtrum:MODulation:EPSK:TCH:LIMit:LINE:SYMMetric[:COMBined]:RPOWer	<Minimum>, <Maximum>	with query	6.152
CONFigure:SPECtrum:MODulation:EPSK:TCH:MPOint<nr>:ENABle	ON | OFF	with query	6.153
FETCh:SPECtrum:MODulation:EPSK:TCH:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE , 1 to 1000 | NONE	only query	6.148
FETCh[:SCALar]:SPECtrum:MODulation:EPSK:TCH?	<Result>	only query	6.155
SAMPle[:SCALar]:SPECtrum:MODulation:EPSK:TCH?	<Result>	only query	6.155
READ:ARRay:SPECtrum:MODulation:EPSK:TCH?	–100.0 dB to +20 dB	only query	6.156
FETCh:ARRay:SPECtrum:MODulation:EPSK:TCH?	–100.0 dB to +20 dB	only query	6.156
SAMPle:ARRay:SPECtrum:MODulation:EPSK:TCH?	–100.0 dB to +20 dB	only query	6.156
READ:SUBarrays:SPECtrum:MODulation:EPSK:TCH?	–100.0 dB to +20 dB	only query	6.156
FETCh:SUBarrays:SPECtrum:MODulation:EPSK:TCH?	–100.0 dB to +20 dB	only query	6.156
SAMPle:SUBarrays:SPECtrum:MODulation:EPSK:TCH?	–100.0 dB to +20 dB	only query	6.156
INITiate:SPECtrum:MODulation:GMSK:CCH	–	no query	6.147
ABORt:SPECtrum:MODulation:GMSK:CCH	–	no query	6.147
STOP:SPECtrum:MODulation:GMSK:CCH	–	no query	6.147
CONTinue:SPECtrum:MODulation:GMSK:CCH	–	no query	6.147

Command	Parameter	Remark	Page
CONFigure:SUBarrays:SPECtrum:MODulation:GMSK:CCH	ALL | ARIThmetical | MINimum | MAXimum,<Start>,<Samples>{,<Start>,<Samples>}	with query	6.154
CONFigure:SPECtrum:MODulation:GMSK:CCH:CONTrol	SCALar | ARRay, 1 to 1000 | NONE, CONTinuous | SINGleshot | 1 to 10000, SOERror | NONE,STEP | NONE	with query	6.148
DEFault:SPECtrum:MODulation:GMSK:CCH:CONTrol	ON | OFF	with query	6.150
CONFigure:SPECtrum:MODulation:GMSK:CCH:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SOERror | NONE, STEP | NONE	with query	6.150
CONFigure:SPECtrum:MODulation:GMSK:CCH:CONTrol:RMODe	SCALar | ARRay	with query	6.149
CONFigure:SPECtrum:MODulation:GMSK:CCH:CONTrol:STATistics	1 to 1000 | NONE	with query	6.149
CONFigure:SPECtrum:MODulation:GMSK:CCH:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.148
DEFault:SPECtrum:MODulation:GMSK:CCH:LIMit:LINE	ON | OFF	with query	6.153
CONFigure:SPECtrum:MODulation:GMSK:CCH:LIMit:LINE:SYMMetric[:COMBined]:ENABle	ON | OFF	with query	6.152
CONFigure:SPECtrum:MODulation:GMSK:CCH:LIMit:LINE:SYMMetric[:COMBined]:FREQuency<nr>	<MinLevel>,<MaxLevel>,<AbsLevel>,<Enable>	with query	6.151
CONFigure:SPECtrum:MODulation:GMSK:CCH:LIMit:LINE:SYMMetric[:COMBined]:FREQuency<nr>:ENABle	ON | OFF	with query	6.151
CONFigure:SPECtrum:MODulation:GMSK:CCH:LIMit:LINE:SYMMetric[:COMBined]:FREQuency<nr>	<MinLevel>,<MaxLevel>,<AbsLevel>	with query	6.151
CONFigure:SPECtrum:MODulation:GMSK:CCH:LIMit:LINE:SYMMetric[:COMBined]:RPOWer	<Minimum>, <Maximum>	with query	6.152
CONFigure:SPECtrum:MODulation:GMSK:CCH:MPOint<nr>:ENABle	ON | OFF	with query	6.153
FETCh:SPECtrum:MODulation:GMSK:CCH:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE , 1 to 1000 | NONE	only query	6.148
FETCh[:SCALar]:SPECtrum:MODulation:GMSK:CCH?	<Result>	only query	6.155
SAMPle[:SCALar]:SPECtrum:MODulation:GMSK:CCH?	<Result>	only query	6.155
READ:ARRay:SPECtrum:MODulation:GMSK:CCH?	–100.0 dB to +20 dB	only query	6.156
FETCh:ARRay:SPECtrum:MODulation:GMSK:CCH?	–100.0 dB to +20 dB	only query	6.156
SAMPle:ARRay:SPECtrum:MODulation:GMSK:CCH?	–100.0 dB to +20 dB	only query	6.156
READ:SUBarrays:SPECtrum:MODulation:GMSK:CCH?	–100.0 dB to +20 dB	only query	6.156

Command	Parameter	Remark	Page
FETCh:SUBarrays:SPECtrum:MODulation:GMSK:CCH?	–100.0 dB to +20 dB	only query	6.156
SAMPle:SUBarrays:SPECtrum:MODulation:GMSK:CCH?	–100.0 dB to +20 dB	only query	6.156
INITiate:SPECtrum:MODulation:GMSK:TCH	–	no query	6.147
ABORt:SPECtrum:MODulation:GMSK:TCH	–	no query	6.147
STOP:SPECtrum:MODulation:GMSK:TCH	–	no query	6.147
CONTinue:SPECtrum:MODulation:GMSK:TCH	–	no query	6.147
CONFigure:SUBarrays:SPECtrum:MODulation:GMSK:TCH	ALL | ARIThmetical | MINimum | MAXimum,<Start>,<Samples>{,<Start>,<Samples>}	with query	6.154
CONFigure:SPECtrum:MODulation:GMSK:TCH:CONTrol	SCALar | ARRay, 1 to 1000 | NONE, CONTinuous | SINGleshot | 1 to 10000, SOERror | NONE,STEP | NONE	with query	6.148
DEFault:SPECtrum:MODulation:GMSK:TCH:CONTrol	ON | OFF	with query	6.150
CONFigure:SPECtrum:MODulation:GMSK:TCH:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SOERror | NONE, STEP | NONE	with query	6.150
CONFigure:SPECtrum:MODulation:GMSK:TCH:CONTrol:RMODe	SCALar | ARRay	with query	6.149
CONFigure:SPECtrum:MODulation:GMSK:TCH:CONTrol:STATistics	1 to 1000 | NONE	with query	6.149
CONFigure:SPECtrum:MODulation:GMSK:TCH:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.148
DEFault:SPECtrum:MODulation:GMSK:TCH:LIMit:LINE	ON | OFF	with query	6.153
CONFigure:SPECtrum:MODulation:GMSK:TCH:LIMit:LINE:SYMMetric[:COMBined]:ENABle	ON | OFF	with query	6.152
CONFigure:SPECtrum:MODulation:GMSK:TCH:LIMit:LINE:SYMMetric[:COMBined]:FREQuency<nr>	<MinLevel>,<MaxLevel>,<AbsLevel>,<Enable>	with query	6.151
CONFigure:SPECtrum:MODulation:GMSK:TCH:LIMit:LINE:SYMMetric[:COMBined]:FREQuency<nr>:ENABle	ON | OFF	with query	6.151
CONFigure:SPECtrum:MODulation:GMSK:TCH:LIMit:LINE:SYMMetric[:COMBined]:FREQuency<nr>	<MinLevel>,<MaxLevel>,<AbsLevel>	with query	6.151
CONFigure:SPECtrum:MODulation:GMSK:TCH:LIMit:LINE:SYMMetric[:COMBined]:RPOWer	<Minimum>, <Maximum>	with query	6.152
CONFigure:SPECtrum:MODulation:GMSK:TCH:MPOint<nr>:ENABle	ON | OFF	with query	6.153
FETCh:SPECtrum:MODulation:GMSK:TCH:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE , 1 to 1000 | NONE	only query	6.148

Command	Parameter	Remark	Page
FETCh[:SCALar]:SPECtrum:MODulation:GMSK:TCH?	<Result>	only query	6.155
SAMPle[:SCALar]:SPECtrum:MODulation:GMSK:TCH?	<Result>	only query	6.155
READ:ARRay:SPECtrum:MODulation:GMSK:TCH?	–100.0 dB to +20 dB	only query	6.156
FETCh:ARRay:SPECtrum:MODulation:GMSK:TCH?	–100.0 dB to +20 dB	only query	6.156
SAMPle:ARRay:SPECtrum:MODulation:GMSK:TCH?	–100.0 dB to +20 dB	only query	6.156
READ:SUBarrays:SPECtrum:MODulation:GMSK:TCH?	–100.0 dB to +20 dB	only query	6.156
FETCh:SUBarrays:SPECtrum:MODulation:GMSK:TCH?	–100.0 dB to +20 dB	only query	6.156
SAMPle:SUBarrays:SPECtrum:MODulation:GMSK:TCH?	–100.0 dB to +20 dB	only query	6.156
READ[:SCALar]:SPECtrum:Modulation:TCH?	<Result>	only query	6.155
READ[:SCALar]:SPECtrum:Modulation:TCH?	<Result>	only query	6.155
Spectrum due to switching measurements			
INITiate:SPECtrum:SWITching:EPSK:TCH	–	no query	6.157
ABORt:SPECtrum:SWITching:EPSK:TCH	–	no query	6.157
STOP:SPECtrum:SWITching:EPSK:TCH	–	no query	6.157
CONTinue:SPECtrum:SWITching:EPSK:TCH	–	no query	6.157
CONFigure:SUBarrays:SPECtrum:SWITching:EPSK:TCH	ALL | ARIThmetical | MINimum | MAXimum,<Start>,<Samples>{,<Start>,<Samples>}	with query	6.163
SAMPle[:SCALar]:SPECtrum:SWITching:EPSK:TCH ?	<Result>	only query	6.164
CONFigure:SPECtrum:SWITching:EPSK:TCH:CONTrol	SCALar | ARRay, 1 to 1000 | NONE, CONTinuous | SINGleshot | 1 to 10000, SOERror | NONE,STEP | NONE	with query	6.158
DEFault:SPECtrum:SWITching:EPSK:TCH:CONTrol	ON | OFF	with query	6.160
CONFigure:SPECtrum:SWITching:EPSK:TCH:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SOERror | NONE, STEP | NONE	with query	6.160
CONFigure:SPECtrum:SWITching:EPSK:TCH:CONTrol:RMODe	SCALar | ARRay	with query	6.159
CONFigure:SPECtrum:SWITching:EPSK:TCH:CONTrol:STATistics	1 to 1000 | NONE	with query	6.159
CONFigure:SPECtrum:SWITching:EPSK:TCH:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.158
DEFault:SPECtrum:SWITching:EPSK:TCH:LIMit:LINE	ON | OFF	with query	6.162
CONFigure:SPECtrum:SWITching:EPSK:TCH:LIMit:LINE:SYMMetr	ON | OFF	with query	6.162

Command	Parameter	Remark	Page
ic[:COMBined]:ENABle			
CONFigure:SPECtrum:SWITching:EPSK:TCH:LIMit:LINE:SYMMetric[:COMBined]:FREQuency<nr>	<MinLevel>,<MaxLevel>,<AbsLevel>,<Enable>	with query	6.161
CONFigure:SPECtrum:SWITching:EPSK:TCH:LIMit:LINE:SYMMetric[:COMBined]:FREQuency<nr>:ENABle	ON | OFF	with query	6.161
CONFigure:SPECtrum:SWITching:EPSK:TCH:LIMit:LINE:SYMMetric[:COMBined]:FREQuency<nr>	<MinLevel>,<MaxLevel>,<AbsLevel>	with query	6.161
CONFigure:SPECtrum:SWITching:EPSK:TCH:MPOint<nr>:ENABle	ON | OFF	with query	6.162
FETCh:SPECtrum:SWITching:EPSK:TCH:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE , 1 to 1000 | NONE	only query	6.158
READ[:SCALar]:SPECtrum:SWITching:EPSK:TCH?	<Result>	only query	6.164
FETCh[:SCALar]:SPECtrum:SWITching:EPSK:TCH?	<Result>	only query	6.164
READ:ARRay:SPECtrum:SWITching:EPSK:TCH?	–100.0 dB to +20 dB	only query	6.165
FETCh:ARRay:SPECtrum:SWITching:EPSK:TCH?	–100.0 dB to +20 dB	only query	6.165
SAMPle:ARRay:SPECtrum:SWITching:EPSK:TCH?	–100.0 dB to +20 dB	only query	6.165
READ:SUBarrays:SPECtrum:SWITching:EPSK:TCH?	–100.0 dB to +20 dB	only query	6.165
FETCh:SUBarrays:SPECtrum:SWITching:EPSK:TCH?	–100.0 dB to +20 dB	only query	6.165
SAMPle:SUBarrays:SPECtrum:SWITching:EPSK:TCH?	–100.0 dB to +20 dB	only query	6.165
INITiate:SPECtrum:SWITching:GMSK:CCH	–	no query	6.157
ABORt:SPECtrum:SWITching:GMSK:CCH	–	no query	6.157
STOP:SPECtrum:SWITching:GMSK:CCH	–	no query	6.157
CONTinue:SPECtrum:SWITching:GMSK:CCH	–	no query	6.157
CONFigure:SUBarrays:SPECtrum:SWITching:GMSK:CCH	ALL | ARIThmetical | MINimum | MAXimum,<Start>,<Samples>{,<Start>,<Samples>}	with query	6.163
SAMPle[:SCALar]:SPECtrum:SWITching:GMSK:CCH ?	<Result>	only query	6.164
CONFigure:SPECtrum:SWITching:GMSK:CCH:CONTrol	SCALar | ARRay, 1 to 1000 | NONE, CONTinuous | SINGleshot | 1 to 10000, SOERror | NONE,STEP | NONE	with query	6.158
DEFault:SPECtrum:SWITching:GMSK:CCH:CONTrol	ON | OFF	with query	6.160
CONFigure:SPECtrum:SWITching:GMSK:CCH:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SOERror | NONE, STEP | NONE	with query	6.160

Command	Parameter	Remark	Page
CONFigure:SPECtrum:SWITching:GMSK:CCH:CONTrol:RMODe	SCALar | ARRay	with query	6.159
CONFigure:SPECtrum:SWITching:GMSK:CCH:CONTrol:STATistics	1 to 1000 | NONE	with query	6.159
CONFigure:SPECtrum:SWITching:GMSK:CCH:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.158
DEFault:SPECtrum:SWITching:GMSK:CCH:LIMit:LINE	ON | OFF	with query	6.162
CONFigure:SPECtrum:SWITching:GMSK:CCH:LIMit:LINE:SYMMetric[:COMBined]:ENABle	ON | OFF	with query	6.162
CONFigure:SPECtrum:SWITching:GMSK:CCH:LIMit:LINE:SYMMetric[:COMBined]:FREQuency<nr>	<MinLevel>,<MaxLevel>,<AbsLevel>,<Enable>	with query	6.161
CONFigure:SPECtrum:SWITching:GMSK:CCH:LIMit:LINE:SYMMetric[:COMBined]:FREQuency<nr>:ENABle	ON | OFF	with query	6.161
CONFigure:SPECtrum:SWITching:GMSK:CCH:LIMit:LINE:SYMMetric[:COMBined]:FREQuency<nr>	<MinLevel>,<MaxLevel>,<AbsLevel>	with query	6.161
CONFigure:SPECtrum:SWITching:GMSK:CCH:MPOint<nr>:ENABle	ON | OFF	with query	6.162
FETCh:SPECtrum:SWITching:GMSK:CCH:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE , 1 to 1000 | NONE	only query	6.158
READ[:SCALar]:SPECtrum:SWITching:GMSK:CCH?	<Result>	only query	6.164
FETCh[:SCALar]:SPECtrum:SWITching:GMSK:CCH?	<Result>	only query	6.164
READ:ARRay:SPECtrum:SWITching:GMSK:CCH?	–100.0 dB to +20 dB	only query	6.165
FETCh:ARRay:SPECtrum:SWITching:GMSK:CCH?	–100.0 dB to +20 dB	only query	6.165
SAMPle:ARRay:SPECtrum:SWITching:GMSK:CCH?	–100.0 dB to +20 dB	only query	6.165
READ:SUBarrays:SPECtrum:SWITching:GMSK:CCH?	–100.0 dB to +20 dB	only query	6.165
FETCh:SUBarrays:SPECtrum:SWITching:GMSK:CCH?	–100.0 dB to +20 dB	only query	6.165
SAMPle:SUBarrays:SPECtrum:SWITching:GMSK:CCH?	–100.0 dB to +20 dB	only query	6.165
INITiate:SPECtrum:SWITching:GMSK:TCH	–	no query	6.157
ABORt:SPECtrum:SWITching:GMSK:TCH	–	no query	6.157
STOP:SPECtrum:SWITching:GMSK:TCH	–	no query	6.157
CONTinue:SPECtrum:SWITching:GMSK:TCH	–	no query	6.157
CONFigure:SUBarrays:SPECtrum:SWITching:GMSK:TCH	ALL | ARIThmetical | MINimum | MAXimum,<Start>,<Samples> {,<Start>,<Samples>}	with query	6.163
SAMPle[:SCALar]:SPECtrum:SWITching:GMSK:TCH ?	<Result>	only query	6.164

Command	Parameter	Remark	Page
CONFigure:SPECtrum:SWITching:GMSK:TCH:CONTrol	SCALar | ARRay, 1 to 1000 | NONE, CONTinuous | SINGleshot | 1 to 10000, SOERror | NONE,STEP | NONE	with query	6.158
DEFault:SPECtrum:SWITching:GMSK:TCH:CONTrol	ON | OFF	with query	6.160
CONFigure:SPECtrum:SWITching:GMSK:TCH:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SOERror | NONE, STEP | NONE	with query	6.160
CONFigure:SPECtrum:SWITching:GMSK:TCH:CONTrol:RMODe	SCALar | ARRay	with query	6.159
CONFigure:SPECtrum:SWITching:GMSK:TCH:CONTrol:STATistics	1 to 1000 | NONE	with query	6.159
CONFigure:SPECtrum:SWITching:GMSK:TCH:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.158
DEFault:SPECtrum:SWITching:GMSK:TCH:LIMit:LINE	ON | OFF	with query	6.162
CONFigure:SPECtrum:SWITching:GMSK:TCH:LIMit:LINE:SYMMetric[:COMBined]:ENABle	ON | OFF	with query	6.162
CONFigure:SPECtrum:SWITching:GMSK:TCH:LIMit:LINE:SYMMetric[:COMBined]:FREQuency<nr>	<MinLevel>,<MaxLevel>,<AbsLevel>,<Enable>	with query	6.161
CONFigure:SPECtrum:SWITching:GMSK:TCH:LIMit:LINE:SYMMetric[:COMBined]:FREQuency<nr>:ENABle	ON | OFF	with query	6.161
CONFigure:SPECtrum:SWITching:GMSK:TCH:LIMit:LINE:SYMMetric[:COMBined]:FREQuency<nr>	<MinLevel>,<MaxLevel>,<AbsLevel>	with query	6.161
CONFigure:SPECtrum:SWITching:GMSK:TCH:MPOint<nr>:ENABle	ON | OFF	with query	6.162
FETCh:SPECtrum:SWITching:GMSK:TCH:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE , 1 to 1000 | NONE	only query	6.158
SAMPle:SUBarrays:SPECtrum:SWITching:GMSK:TCH?	–100.0 dB to +20 dB	only query	6.151
READ[:SCALar]:SPECtrum:SWITching:GMSK:TCH?	<Result>	only query	6.164
FETCh[:SCALar]:SPECtrum:SWITching:GMSK:TCH?	<Result>	only query	6.164
READ:ARRay:SPECtrum:SWITching:GMSK:TCH?	–100.0 dB to +20 dB	only query	6.165
FETCh:ARRay:SPECtrum:SWITching:GMSK:TCH?	–100.0 dB to +20 dB	only query	6.165
SAMPle:ARRay:SPECtrum:SWITching:GMSK:TCH?	–100.0 dB to +20 dB	only query	6.165
READ:SUBarrays:SPECtrum:SWITching:GMSK:TCH?	–100.0 dB to +20 dB	only query	6.165
FETCh:SUBarrays:SPECtrum:SWITching:GMSK:TCH?	–100.0 dB to +20 dB	only query	6.165
SAMPle:SUBarrays:SPECtrum:SWITching:GMSK:TCH?	–100.0 dB to +20 dB	only query	6.165
Trigger			

Command	Parameter	Remark	Page
DEFault:TRIGger[:SEQuence]	ON | OFF	with query	6.76
TRIGger[:SEQuence]: THReshold	LOW | MEDium | HIGH	with query	6.76
TRIGger[:SEQuence]:SOURce	SIGNalling | IMMediate | RFPower | IFPower	with query	6.76
Wide-band peak power measurements			
INITiate:WPOWer	–	no query	6.91
ABORt:WPOWer	–	no query	6.91
STOP:WPOWer	–	no query	6.91
CONTinue:WPOWer	–	no query	6.91
CONFigure:WPOWer:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SOERror | NONE,STEP | NONE	with query	6.92
CONFigure:WPOWer:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.91
FETCh:WPOWer:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE	query only	6.91
READ[:SCALar]:WPOWer?	–	query only	6.92
FETCh[:SCALar]:WPOWer?	–	query only	6.92
SAMPle[:SCALar]:WPOWer?	–	query only	6.92

Alphabetical Command Lists

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[SENSe:]CORRection:LOSS:Output<nr>[:MAGNitude]	6.8
[SENSe:]EPOWer:ATTenuation	6.2
[SENSe:]EPOWer:MAXimum	6.2
[SENSe:]EPOWer:MODE	6.1
[SENSe:]RFANalyzer:FOFFset	6.4
[SENSe:]RFANalyzer:FREQuency	6.4
[SENSe:]RFANalyzer:FREQuency:UNIT	6.4
[SENSe:]RFANalyzer:TSEQuence	6.5
ABORt:MODulation:EVMagnitude:EPSK	6.38
ABORt:MODulation:MERRor:EPSK	6.52
ABORt:MODulation:OVERview:EPSK	6.32
ABORt:MODulation:PERRor:EPSK	6.45
ABORt:MODulation:PERRor:GMSK	6.24
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ABORt:POWer:NBURst:GMSK	6.12
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ABORt:SPECtrum:MODulation:GMSK	6.58
ABORt:SPECtrum:SWITching:EPSK	6.67
ABORt:SPECtrum:SWITching:GMSK	6.67
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CALCulate:ARRay:POWer:NBURst:EPSK:AVERage:MATChing:AREA?	6.23
CALCulate:ARRay:POWer:NBURst:EPSK:AVERage:MATChing:LIMit?	6.23
CALCulate:ARRay:POWer:NBURst:EPSK:CURRent:MATChing:AREA?	6.23
CALCulate:ARRay:POWer:NBURst:EPSK:CURRent:MATChing:LIMit?	6.23
CALCulate:ARRay:POWer:NBURst:EPSK:MAXimum:MATChing:AREA?	6.23
CALCulate:ARRay:POWer:NBURst:EPSK:MAXimum:MATChing:LIMit?	6.23
CALCulate:ARRay:POWer:NBURst:EPSK:MINimum:MATChing:AREA?	6.23
CALCulate:ARRay:POWer:NBURst:EPSK:MINimum:MATChing:LIMit?	6.23
CALCulate:ARRay:POWer:NBURst:GMSK:AVERage:MATChing:AREA?	6.23
CALCulate:ARRay:POWer:NBURst:GMSK:AVERage:MATChing:LIMit?	6.23
CALCulate:ARRay:POWer:NBURst:GMSK:CURRent:MATChing:AREA?	6.23
CALCulate:ARRay:POWer:NBURst:GMSK:CURRent:MATChing:LIMit?	6.23
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CALCulate:ARRay:POWer:NBURst:GMSK:MAXimum:MATChing:LIMit?	6.23
CALCulate:ARRay:POWer:NBURst:GMSK:MINimum:MATChing:AREA?	6.23
CALCulate:ARRay:POWer:NBURst:GMSK:MINimum:MATChing:LIMit?	6.23
CALCulate[:SCALar]:MODulation:EVMagnitude:EPSK:MATChing:LIMit?	6.42
CALCulate[:SCALar]:MODulation:MERRor:EPSK:MATChing:LIMit?	6.56
CALCulate[:SCALar]:MODulation:OVERview:EPSK:MATChing:LIMit?	6.37
CALCulate[:SCALar]:MODulation:PERRor:EPSK:MATChing:LIMit?	6.49
CALCulate[:SCALar]:MODulation:PERRor:GMSK:MATChing:LIMit?	6.29
CALCulate[:SCALar]:POWer:NBURst:EPSK:MATChing:LIMit?	6.20
CALCulate[:SCALar]:POWer:NBURst:GMSK:MATChing:LIMit?	6.20
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CONFigure:MODulation:EVMagnitude:EPSK:CONTrol:REPetition	6.40
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CONFigure:MODulation:EVMagnitude:EPSK:EREPorting	6.38
CONFigure:MODulation:MERRor:EPSK:CONTrol	6.53
CONFigure:MODulation:MERRor:EPSK:CONTrol:REPetition	6.54
CONFigure:MODulation:MERRor:EPSK:CONTrol:RMODe	6.54
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CONFigure:MODulation:OEMP:EPSK:CMMax:LIMit[:SCALar]:SYMMetric[:COMBined]	6.35
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CONFigure:MODulation:OVERview:EPSK:EREPorting	6.32
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CONFigure:MODulation:PERRor:EPSK:CONTrol:REPetition	6.47
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CONFigure:SPECtrum:SWITching:EPSK:LIMit:LINE:SYMMetric[:COMBined]:FREQuency<nr>	6.70
CONFigure:SPECtrum:SWITching:EPSK:LIMit:LINE:SYMMetric[:COMBined]:FREQuency<nr>:ENABle	6.70
CONFigure:SPECtrum:SWITching:EPSK:LIMit:LINE:SYMMetric[:COMBined]:FREQuency<nr>:VALue	6.70
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